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Distribution Transformers

Costly departures from standard

ONE of the most significant things in the electrical industry is the increasing demand for distribution transformers, *i.e.*, roughly those with outputs not exceeding 500 kVA which are intended for stepping down to low voltages from 11 kV or less. Satisfaction in these signs of active development is, however, tempered by noticing how large a proportion of such transformers now going through the shops embodies non-standard features that raise the price and impede production.

First, and most obvious, of the departures from normal is the large number of secondary voltages for which transformers are being wound. The implications of this, which go far beyond the effect on cost of production, have often been discussed in our columns. As the Electricity Commissioners have promised to tackle the voltage question, we must leave it at that for the time being.

We need only refer here, as an illustration of the present chaotic conditions and of their urgency, to information given us by one large manufacturer that only about half of the distribution transformers recently ordered for the home market are for 400-230 V. Actually two-thirds of those with 3.3-kV primaries have non-standard secondaries. Although in the 6.6 and 11 kV classes the position is better, since 90 per cent. transform to 400 V, the benefits of conformity are largely offset by purchasers who call for non-standard tappings, as they do in the case of the 3.3-kV class also.

Need for Uniformity in Tappings

Now, while variations from the prescribed voltages may be unavoidable in regard to transformers for existing networks, there is hardly the same reason for purchasers requiring non-standard tappings. Data that have been put before us show that barely a quarter of the transformers now on order for use in this country have the B.S.S. tappings of ± 2½ and 5 per cent. The result is that in the case we have cited, which from observation in other quarters appears to be representative of conditions generally, new winding information has to be prepared and issued to the factory for at least 70 per cent. of the transformers manufactured.

It is not that the differences in the windings amount to much in themselves as a rule, but they are enough to prevent a manufacturer from working to absolutely standard designs on a piece of apparatus that should by now be capable of being bought "off the nail." Those who have been engaged on this side of the work will recognise how small a departure from normal procedure will upset production arrangements and disproportionately add to the cost of an article, the general characteristics of which are similar. Moreover, manufacturers are unable to build up stocks for instant dispatch, while users must carry unremunerative spares because they may not be able to get replacements immediately that are suited to their special requirements.

One manufacturer expresses the pious hope that the present unsatisfactory state of affairs may be rectified in the not too distant future. This seems to us unduly optimistic, as it cannot be argued that conditions have improved to the extent that they should have done since 1925, for example, when Mr. A. G Ellis, in a review of the electrical industry which he presented to the I.E.E. at Manchester, discussed the advantages of standardising transformers.

Compliance with B.S. Specifications

Our correspondence columns have recently given proof of dissatisfaction with tendering conditions generally, many of which are regarded as embodying mere fads. One writer expressed the view that inquirers would be better served if they stated their requirements briefly and allowed the manufacturers to put forward the most economical and the soundest engineering job. There is, however, no need for purchasers to put themselves unreservedly into the hands of manufacturers.

The Electricity Commissioners and the I.E.E. have saved themselves many words in their regulations by reference to appropriate British Standard Specifications. The purchaser can do the same where a suitable specification exists as it does for transformers. The last transformer B.S.S. was drawn up in 1936 by a committee representing all the interests likely to be affected and was issued only after unanimous agreement had been reached.

Nevertheless, it is difficult to imagine that so large a proportion of transformers incorporate non-standard minor items merely as the result of whim. It would be of real advantage to know the reasons underlying departures from British Standards that add to the cost of distribution.

Small Fluorescent Lamps

IT was to be anticipated that the use of fluorescent powders for colour correction would not long be limited to lamps with so large an output as 400 W, and now, just over a year after their introduction, they have been supplemented by 80- and 125-W models. In the meantime investigations have been made into the most suitable size and shape of bulb so that the higher temperatures at which the smaller lamps work would not destroy the stability of the powder. The newcomers do not suffer from loss of efficiency due to colour correction as the larger kind does. In the case of the latter, the combination of the bluish-white light of the discharge itself with the orange-yellow light emitted by the powder (the function of which is to convert invisible ultra-voilet radiations from the mercury discharge to lower frequencies to which the eye is sensitive) results in a light containing about 6 per cent. red, as against 1 to 1½ in the ordinary discharge lamp, which provides colour correction of the same order as that of the smaller lamps. The output, however, is 38 lumens per watt instead of the 45 furnished by the normal 400-W lamp, owing to obstruction to the rays caused by the powder. The 80-W and 125-W lamps, on the other hand, have quartz inner tubes which, unlike glass, give free passage to the ultra-violet rays thus compensating for obstruction by the powder. They should find considerable scope in the many cases in which colour values are important.

I.E.E. Authors

ADVANCE copies of papers to be presented before the several sections of the Institution of Electrical Engineers now have footnotes added which establish the identities of their authors by naming the concerns with which they are associated. This is a long overdue reform and conforms with our own practice when summarising the proceedings of technical organisations. How, in the absence of some such index of professional standing or commercial interest, can the average reader be expected properly to gauge the weight to be attached to an unknown author's pronouncements? Indeed, the leading American institutions go further and define not only an author's occupation but also his status within his particular department. This procedure is not merely desirable, but frequently necessary to balanced judgment, in particular when controversial matter is introduced, or comparisons made. There is no implication, of course, that authors should be confined to subjects in which they specialise. On the contrary, a new outlook is invariably refreshing and can often be enlightening.

Trolley-Buses and Defence

COMMENTING in our last week's leading article on the question of successors to discarded tramways, we concerned ourselves primarily with technical and commercial factors, because we believe that the case for the trolley-bus, in its proper sphere, can be fully made on such grounds alone. We touched only briefly upon another and wider aspect, the overwhelming importance of which was clearly shown by Admiral Wilmot Nicholson in an address (reported by us this week) that he delivered in Manchester on Tuesday. Speaking from his own professional experience he described how, in more ways than are generally realised, dependence of our transport upon sea-borne oil would gravely prejudice the safety of this country in time of war. His conclusion was that a system of urban transport based on oil should, in the national interests, be chosen only if for peace-time purposes it were immeasurably superior to a system based on coal, and that available evidence was against any such view. The article by Mr. J. H. Parker in our last issue should be conclusive on this point, and if anything more were needed the Admiral's words would substantiate the claims of the trolley-bus beyond any doubt.

The I.M.E.A. Council

FOR some time past the smaller-undertaking members of the Incorporated Municipal Electrical Association have been dissatisfied with the basis of representation on the Council of the Association. A sub-committee was therefore set up to propose an alteration in the system and its report came before an extraordinary general meeting of the Association last week. It did not prove acceptable, but a friendly spirit was evident in the discussion and finally it was decided to defer the matter in order that a compromise going some way to meet the views of all parties could be reached. The matter is one which is capable of being peacefully solved, and we look forward to the early settlement of a matter which, with less balanced judgment, might have had serious consequences for the I.M.E.A.

"Square Deal" for Contractors

AT last week's E.C.A. dinner Mr. Walter Riggs, the President, returned once more to the attack on supply authorities. He accused them of a determination to "chase the contractors out of their territories," one means of doing this being to cut rates to reduce the cost of installation work to a level at which contractors were unable to compete. We cannot believe that there is really such a vendetta, and feel that any unfair competition which may exist is due to the idea that what is lost on the installation will be gained by the sale of electricity. Mr. Riggs admitted that there were many supply authorities—company and municipal—which maintained the best and most businesslike relations with their local contractors, showing that it is possible to achieve harmony. It was not, however, unreasonable of him to demand a "square deal" for the contractors who, after all, have been responsible for a considerable amount of electrical development. What is the I.M.E.A.—E.C.A. Joint Committee doing these days?

Emergency Supplies

SOME years ago we commended the policy of Mr. C. G. Morley New when he was in charge of the Cardiff undertaking of running cables into every works, if only to provide stand-by to an existing plant. This policy met with its reward when the industrialist found it expedient, as he very often did, to use the service to supply his extensions and ultimately his existing load, which might not be electrical in the first instance. Many supply engineers, naturally enough, perhaps, do not care about providing plant and mains to meet sudden demands of short duration, although if there were a number of such connections the diversity between the demands would be enough to reduce considerably the standing charges which the undertaking is empowered to make for the convenience. In view of the difficulties in which an industrial concern might find itself if its own plant were damaged and put out of commission (perhaps for a long time) by aircraft or other causes, early arrangements should be made as part of A.R.P. for adequate stand-by to be afforded from the public mains.

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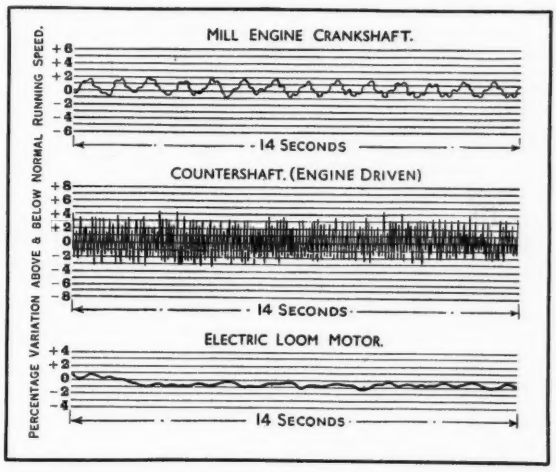
The Textile Industry

Its influence on electricity supply

WHEN, some months ago, we set ourselves the task of trying to assess the influence of the various industries on public electricity supply, we chose the textile group to be the first, partly because we thought it would probably be the most difficult one to tackle. The task certainly has been difficult, mainly for three reasons: (1) The depressed state of the industry at present as the result of severe cheap-labour foreign competition; (2) the process steam problem which confronts the supply man in the textile areas to a far greater extent than it does in other areas, and (3) the characteristic aversion of the cotton-mill man to "outside development" after a very long period of outstanding successes.

Our attitude towards the Lancastrian is one of gratefulness for his co-operation, and we have learnt to admire his determination, but in the interests of accuracy in presenting a picture from our investigation we must cite the very real difficulty arising out of the local characteristic referred to.

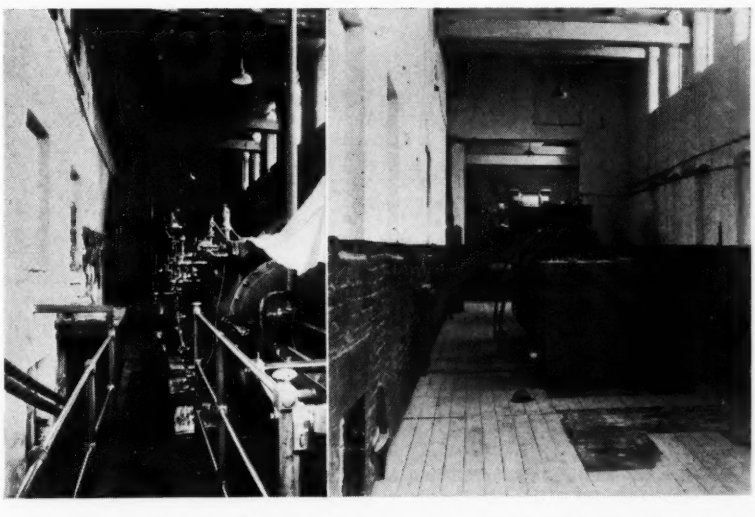
We are also grateful to the supply undertakings which have helped us, including those which have been unable to meet our request for information. The latter have in fact enlightened us as to some of the difficulties in the early stages. Generally, their attitude has been that, because of the depressed state of the textile industry, the present time is not opportune for such a venture as this. We, on the other hand, feel that in an attempt to determine the effect of the main industries of this country on public electricity supply, it is inadvisable to omit one industry which, because of its depressed state, is exerting a very marked influence.



Speed variation diagrams of a Yorkshire weaving shed mill engine, counter-shaft and loom motor

Beyond doubt the principal consideration at the present time as far as the cotton section of the textile industry is concerned is the depression (or shall we say "decline"?) for we have heard it asked in several authoritative quarters: "Will the industry survive?" Well-equipped mills which have represented a profitable field of development for supply undertakings are being broken up in large numbers, and several authorities have told us that unless legislation can in some way or other bring about an improvement, electricity supply must suffer a very severe set-back.

Behind all this there is one aspect which has encouraged us to go ahead with our project and refuse the requests that have been put to us not to proceed with something that can result only in a "black picture." That aspect is that the textile industry is still a leading one, still the one with by far the greatest opposition to electricity supply on account of competitive methods of driving, and we have yet to hear an authoritative electrical man say that it is beyond the electrical industry to help the textile industry considerably.



The engine house at Green Croft Mill, Hyde, before and after replacement of the Jumbo engine by a 450-HP motor

The Yorkshire Electric Power Co. says experience has shown that electrical driving from a public supply represents many advantages to the textile trade. The public supply of electricity represents a regularity of speed and freedom from cyclic variations which are inseparable from steam engines and are most marked in oil and gas engines. This regularity of speed has its effect, not only on the quantity of material produced, but also on its quality. These facts are shown by the accompanying speed variation diagrams taken in a weaving shed driven by mechanical means.

One of the biggest difficulties facing the undertakings is the great effort which mill owners are making to get tariff reductions. Mr. Abson, of the Stockport undertaking, said that some textile engineers want the results of improved efficiency in generation passed on to them without proper regard to the capital expenditure on new generating plant and the residual capital value of the older and less efficient plant which has been replaced. In view of the fact that the power cost to the mill is a very small proportion of the total cost of production, is not the textile engineer paying too much attention to this aspect of his production?

In a recent lecture to the Rochdale Cotton Spinning Mutual Improvement Society, Mr. F. G. Bennett, of the Metropolitan-Vickers Electrical Co., Ltd., gave the power and fuel cost of the cotton spinning industry as 5 per cent. of the total, the other allocations being: materials 50 per cent., labour 34 per cent. and trade expenses 11 per cent. The Y.E.P. writes:—"To-day no mill owner can afford to spend his time or thought on power production. The problems of his trade should be his first thought and he should leave the driving of his mill to those who specialise in the production of power. Trade conditions are always changing, and with these changes more or less power is required. Departments may be working overtime or on short time, new machines may be required and others may be substituted. No self-contained power plant can meet these changing conditions as efficiently as a public supply of electricity, and the subdivision of the mill by the use of separate electric motors enables a machine or a department to be run at a time when other machinery is idle, without the heavy cost of running the mill engine and line shafting."

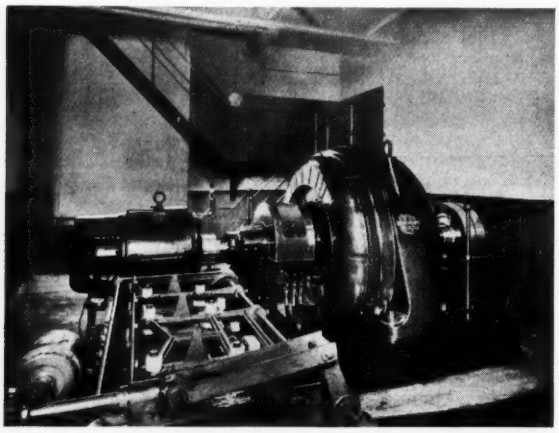
Another factor to be taken into account is the differences of the classes and qualities of the products of different towns. The tendency is for one town to concentrate on one type of, or even just one, product. This state of affairs introduces such an "anomaly" as that at Burnley where, we believe, there is not a single mill on public supply. The looms there require, individually, very little power, and we have heard of an intense effort by an electrical manufacturing company which went so far as actually to put in and run an electrical installation, only to withdraw it later when it became obvious that the owner would not be convinced of the advantages.

Another angle of the depression is presented by the Bolton undertaking, which writes: "Bolton, with a population approaching 180,000, is very largely dependent upon the cotton industry, which has for some time experienced a slump. Such a state of affairs necessarily retards the growth of the

electricity undertaking, apart from the supply afforded directly for spinning and weaving purposes, as the spending power of the population as a whole is reduced."

One of the most interesting influences of the textile load is that on load factor, but it is a particularly difficult one to assess accurately. In any one undertaking during the textile industry's fluctuations of the last few years other loads, especially domestic, have grown and varied, so that the relationship between the textile and other loads is rarely twice alike. Moreover, the proportion of the textile load to the overall load is different for every undertaking, and each undertaking has its own peculiar characteristic of load concentration.

That the general influence of the textile load on load factor is definitely a good one, however, is certain, and several under-



350-HP, 500-kVA synchronous motor driving 14 pairs of mules in a mill at Bolton

takings have commented to us on its steadying effect on the general supply conditions. A good average figure of 25 per cent. may be compared with, for instance, the 12 per cent. load factor of an average engineering works. Ring spinning frames are particularly good, in that they run continuously and at practically constant load throughout the shift. Mules are nearly as good, and stoppages are not really serious in the case of weaving. On this question of load factor, however, there is a distinct line of demarcation between the cotton and wool sections of the industry. Whereas in good times more than one shift may be worked in the wool areas, in Lancashire anything beyond a little overtime on the ordinary day shift is frowned upon.

Rochdale, the undertaking with the largest proportion of textile load of those sending us in information, has a system load factor of 32.5 per cent., whereas the load factor of its textile consumers is 27.3 per cent., and in all cases the textile consumers' load factor is lower than the overall load factor of the supply system. A spinning mill with a demand of 1,693 kW consumed during the good

Individually driven looms at the all-electric mill of J. & J. A. Porter, Ltd., Blackburn

year ending April 1st, 1937, 3.4 million kWh, and it had a load factor of 22.5 per cent. On the other hand, mills manufacturing cotton yarn for a special fabric employ part or the whole of the machinery during the night. The continuation of the practice depends solely on the demand for the fabric, and may cease at any time. One mill with a demand of 11,621 kW in 1937-8 had a load factor of nearly 30 per cent. owing to the night load of part of the machinery. Five mills with a total demand of 13,520 kW have a load factor of about 30 per cent., which is responsible for the apparently higher textile load factor of the whole over the average of mills employed for forty-eight hours per week.

Bolton, with a total output of 104 million kWh, supplies 47 million kWh, or just over 45 per cent., to the textile industry, and its system and textile-consumers' load factors are 34 per cent. and 26.8 per cent. (on a continuous maximum load basis), respectively. As the mills work the same hours there is no diversity to increase the latter factor, so that additional textile consumers do not result in an improved load factor.

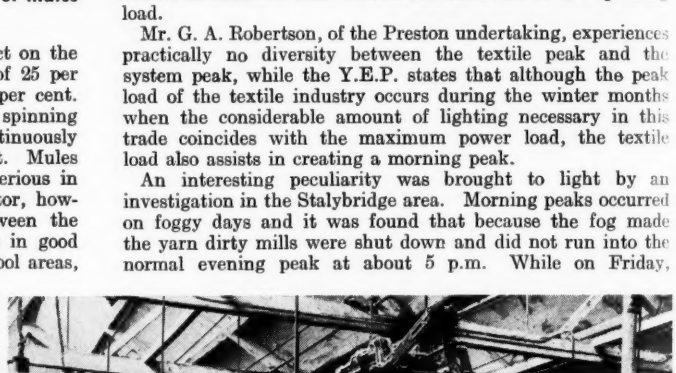
Bradford provides 25 per cent. of its total output and 50 per cent. of its power output to the textile industry, and with a total output of 165.1 million kWh it has a system load factor of 38 per cent., while the load factors of its textile consumers vary from 15 per cent. to 40 per cent. Another member of the "100 million class" is Salford, where there is a much greater diversity of industry and the textile output is less than 10 per cent. of the whole (111.8 million kWh). Blackburn, which issues 13 per cent. of its 52.9 million kWh to the textile industry, has a system load factor of 35 per cent., while the consumers' load factor is 20 to 23 per cent. Ten per cent. of the output of the Y.E.P. represents textile load, and in this instance there is a 42 per cent. system load factor and a 25 per cent. textile load factor.

Nearly all the undertakings have reported that the peak load of the textile consumers comes at the time of the system peak and that generally the peak is in the evening. From Bolton we learn that mills do not operate under maximum load conditions the whole time, and that the mill-lighting load, which has a very poor load factor, comes on at times of peak load during the winter months, while at other times it is practically non-existent. This, to a certain extent, is rectified so far as the whole undertaking is concerned by the fact that the power taken by machinery when starting up and in running until it has obtained normal temperature is greater than the average. But when the increasing domestic load attains such a proportion as to make the peak load of the undertaking take place in the early morning, this rectification will not obtain. So far as the textile load is concerned the lighting load on winter mornings coincides with the demand for maximum power, and it may be taken that under normal working conditions the load factor of a mill rarely exceeds 23 per cent., and under present conditions in many cases is as low as 17 per cent.

Mr. F. H. Rudd reports from Rochdale that in the winter months there is a peak load at about 9 a.m., due mainly to mill lighting and to some extent to the increase in friction of the running load caused by cold weather. Only in severe and foggy weather is that peak exceeded by the evening peak, and then only by a small margin. In summer the peak occurs at about 11 a.m. and is characteristic of the spinning load.

Mr. G. A. Robertson, of the Preston undertaking, experiences practically no diversity between the textile peak and the system peak, while the Y.E.P. states that although the peak load of the textile industry occurs during the winter months when the considerable amount of lighting necessary in this trade coincides with the maximum power load, the textile load also assists in creating a morning peak.

An interesting peculiarity was brought to light by an investigation in the Stalybridge area. Morning peaks occurred on foggy days and it was found that because the fog made the yarn dirty mills were shut down and did not run into the normal evening peak at about 5 p.m. While on Friday,

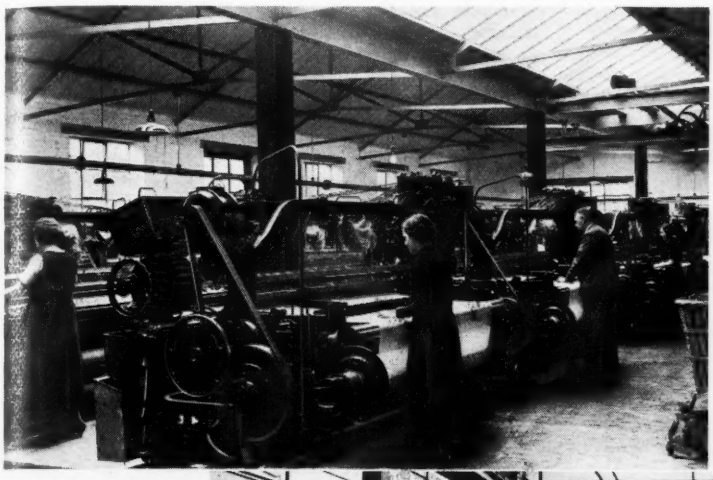


January 20th the peak for the Stalybridge undertaking was at 8.30 a.m., on each other working day of the same week it was at 5 p.m.

We have already referred to the difficulty of assessing the general influence of the textile industry on electricity supply because of the growth of the domestic and other loads in the past few years, and this must be stressed particularly when referring to the variations of the textile load. At Rochdale the slump in the cotton trade has been responsible for a fall in the sales of about 4 million kWh during the last year, due almost entirely to the non-production of the special fabrics referred to. The m.d. of one mill has fallen from 1,000 kW to 600 kW.

At Huddersfield, on the other hand, where the textile output

is a small proportion of the total output, the effect of the textile load variations is not appreciable. Mr. G. A. Vowles, of Halifax, tells us that the slump has been responsible for almost completely nullifying the progress which had been made in the power section of the industry during the past twelve months. From January to June, 1937, the output of the undertaking was 32.169 million kWh, while from January to June, 1938, the output was 32.291 million kWh.



The Bradford undertaking has not been subject to considerable variations in the load (as distinct from the consumption) of textile consumers, as even in years of serious trade depression the load has not fallen to any marked extent. This is probably accounted for by the fact that any tendency towards reduction in such years has been largely counterbalanced by the additional textile load obtained from time to time. From Blackburn we learn that the only variation is when the mills are closed down completely.

In power factor there is a very decided influence on the electricity supply, although the effect is hidden in most places because of the inducement of "artificial" power factor both for the system and individual consumers. Mr. Buckley (Stalybridge) told us of a peculiarity of the cotton trade in that to get the best operating results with the individually driven mule-frame mill it is necessary to overload the motors at one period of the operation. This is during the first 18 inches "draw-out" of the mule when the yarn is stretched, and 25 per cent. overload affords the desirable rotor slip. Furthermore, all the working motors are normally fully loaded and, without correction, a power factor of 70 per cent. to 75 per cent. is usual. Obviously, then, on an uncorrected basis the textile load exerts a very real influence on public supply and indirectly the influence must exist where there is correction; for either the consumer or the undertaking has less correction to effect. The approximate power factor of the Preston undertaking is 0.78, and the maximum and minimum recorded power factors of individual consumers are 0.98 and 0.75 respectively.

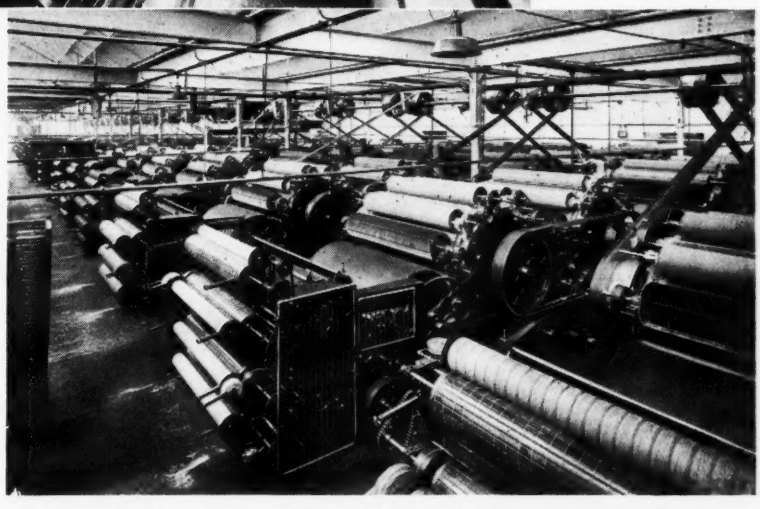
Mr. Annett, of Bolton, says that the tariffs of his undertaking are favourable for the inducement of high power factor and most of the textile consumers have correcting equipment to take advantage of this, so that the power factor under normal full-load conditions is about 0.9 for both consumers and the undertaking.

In the case of certain consumers charged on a special rate, Bradford insists upon their maintaining a power factor of not less than 0.95, and in the case of consumers charged on the ordinary power rates the standing charge is based on so much kVA, so that the overall power factor is relatively high—0.89. Most of the consumers at Halifax have corrected power factor to above 0.9.

While negotiations for supplies to consumers are necessarily carried out individually, the overall influence of the textile load is generally taken into account when drawing up contracts. Indeed, in many cases special standard tariffs are available to textile consumers, carefully worked out from the general influence of the whole. For instance, the Stalybridge undertaking has a special tariff based on load factor and power factor, but it is not available to the dyeing and finishing works, where the high load factor characteristics referred to do not prevail. At Blackburn textile consumers are considered in groups or as single consumers, according to the characteristics of the load. For consumers with over 100 kW demand a block tariff is available, as follows: Up to 30,000 kWh per month, 0.65d. per kWh; to 60,000 kWh per month, 0.5d. per kWh; above 60,000 kWh, 0.425d. per kWh.

The Y.E.P. has broadly, five main classes of textile consumers, namely, mungo and shoddy, woollen and worsted, cotton, dyeing and finishing, and such miscellaneous sections as silk and artificial silk and carpets and clothing. Each class includes many different processes of which one or several may be carried out by any particular mill. Conditions and use of electricity may vary very considerably between one process and another, even in the same class of trade. For this reason the company considers it impracticable to treat each process or even each class separately.

The majority of textile mills in this country are mechanically driven and mill owners cling tenaciously to the existing group drives and shafting and belt layouts. Further, boilers are

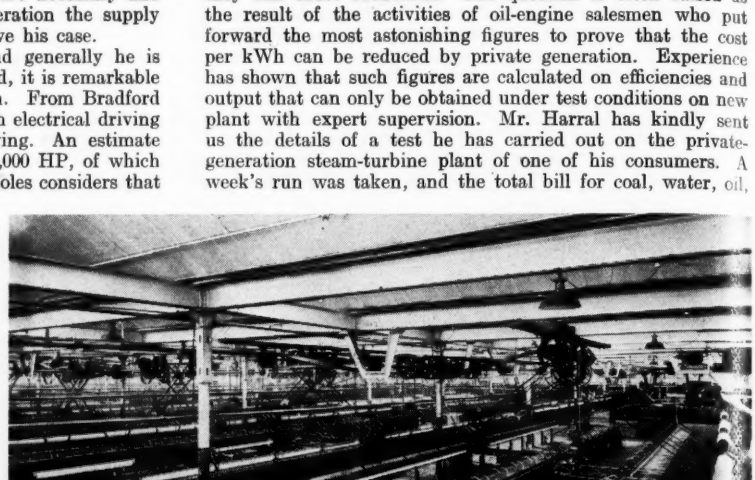


From top to bottom:—Automatic looms individually driven by E.E. Motors at the converted Prospect Mills, Huddersfield. Individually driven looms in a Bradford mill, with 1 HP, 960 RPM to 150 RPM V-rope transmissions. Typical wool mill conversion scheme: 100-HP and 70-HP motors in roof chain driving lineshafts operating 70 carding machines

needed for process steam for humidification and sizing. From a load-building angle, then, these facts represent a tremendous influence on electricity supply, for, as Mr. Fox of Metropolitan-Vickers put it, where boilers are necessary and there are economical steam engines in operation the supply man has a particularly difficult task to prove his case.

But the point is, he *has* got a case, and generally he is undaunted in his efforts to prove it. Indeed, it is remarkable what progress has been made in conversion. From Bradford we learn of very keen competition with both electrical driving by private generation and mechanical driving. An estimate of the competitive power in the area is 54,000 HP, of which about 10,650 kVA is electrical plant. Mr. Roles considers that the prospects of capturing the private-generation load are not good, because that load is largely handled by modern plant where a considerable amount of steam is used for process work.

With regard to mechanical drives, however, the prospects are quite reasonable from the point of view of replacing obsolete plant, except where process steam is needed in large quantities. At Blackburn the cotton mills are driven largely by steam engines and, while engines are in splendid condition, the steam-raising plant has depreciated to a greater extent. It has, therefore, been the practice for some time to relieve the engine and boiler plant by the introduction of separate electric drives in such departments as preparation, warping and winding. The chief difficulty at the present moment is the financial position of the cotton trade, and despite the fact that the undertaking is able to offer attractive terms, it is difficult to persuade owners to scrap existing machinery and provide new capital for motors and alterations to drives.



Mule spinning loom in wool mill: five group drives from 40-HP motors

Mr. Rudd (Rochdale) says that the mills in his area not already driven from public supply have most excellent and economical steam engines, and not until breakdowns take place does he expect to displace them as capital charges then enter into the comparative costs. If they took over all the mills driven by steam, they would about double their textile load. Under the present financial state of the cotton trade, he says, there is little prospect of capturing the mechanical load, and there is no desire to have it unless conditions improve.

At Stalybridge the proportions of mechanical drive and public supply are about equal, and we were told that introductions of electricity supply usually result from the insurance companies lowering the ratings of the engines and boilers. Eventually, after several rating reductions, the coal bill becomes such that it is uneconomical to run the engine, and that is the moment that public supply has waited for. Where the steam plant is in good condition, said Mr. Buckley, it is cheaper to run than electricity for capacities above 400 HP. Mr. Fox (Metropolitan-Vickers) said that the moment the installed horse-power costs of the steam set exceed about 0.35d. electrification possibilities are worth investigating.

Much in the way of conversion is done as the result of breakdowns of existing plant when electrical driving can be established in a couple of days or so—sometimes a few hours—against a delivery time of several weeks for new mechanical plant. At the mill at Idle, Bradford, of G. Garnett & Sons, 7,000 cap-spinning and twisting spindles were driven *via* heavy spur and pinion gear from a tandem compound condensing engine. On a Friday morning, as the result of some of the gear teeth breaking and becoming jammed in the gearing, there was a complete smash. It was found that two to three months would be required to effect a complete repair. An investigation by the Bradford undertaking showed that the top room of spinning plant could be driven by a 150-HP motor and that the bottom room of drawing machinery could be dealt with by a 90-HP motor. The undertaking was entrusted with the establishment of electrical driving on the following Monday, and within the next seven days the conversion was effected. The work embraced the laying of 700 yards of 6.6-kV cable and the erection of extra-high-voltage switchgear, transformers, etc.

It is curious how the extent of private generation varies. In the Y.E.P. area at least 75 per cent. of the textile mills generate electricity, although only a small proportion of them do so for the driving of the mills as a whole. In Rochdale there is practically no private generation except for a few mills where plants of about 20 kW handle the lighting—a load which is not very attractive, says Mr. Rudd.

The Blackburn undertaking writes that from time to time the question of installing private plant is considered by consumers, who imagine themselves ill-treated and believe that they can effect economies. The question is often raised as the result of the activities of oil-engine salesmen who put forward the most astonishing figures to prove that the cost per kWh can be reduced by private generation. Experience has shown that such figures are calculated on efficiencies and output that can only be obtained under test conditions on new plant with expert supervision. Mr. Harral has kindly sent us the details of a test he has carried out on the private-generation steam-turbine plant of one of his consumers. A week's run was taken, and the total bill for coal, water, oil, wages, insurances, supplementary purchased power and maintenance for the generation of 13,127 kWh amounted to £42 17s. 2d., or 0.783d. per kWh generated.

This represents an annual expenditure (50 weeks) of £2,142 18s. 4d. Against this the undertaking's two-part tariff of £3 10s. per kW and 0.3d. per kWh (less 2½ per cent.) showed a saving of £353 7s. 4d. (£1,789 11s. against £2,142 18s. 4d.), or the alternative block tariff of 360,000 kWh at 0.65d. per kWh and 296,350 kWh at 0.55d. per kWh showed a saving of £530 2s. 8d. (£1,612 15s. 8d. against £2,142 18s. 4d.). The plant has since been scrapped and the mill is now on public supply.

FORTHCOMING EVENTS

Institution of Electrical Engineers.—Thursday, February 9th. Grosvenor House, Park Lane, London, W.1. 7 for 7.30 p.m. Annual dinner.

Informal meeting.—Monday, February 6th. Institution, London, W.C.2. 6.30 p.m. Joint meeting with the Institutions of Civil and Mechanical Engineers. Discussion on "The Preparation and Giving of Expert Evidence," to be opened by Mr. J. H. Rider.

Tuesday, February 7th. University College, Nottingham. Joint meeting with the Institutions of Mechanical Engineers and Post Office Electrical Engineers. "Long-Distance Telephonic Communication," by Mr. A. Brookes.

South Midland Centre.—Monday, February 6th. James Watt Memorial Institute, Great Charles Street, Birmingham. 7 p.m. "The Application of Electric Heating to Domestic Hot-Water Supply Systems," by Mr. J. I. Bernard.

Hampshire Sub-Centre.—Wednesday, February 8th. University College, Southampton. 7.30 p.m. "Rural Electrification," by Mr. J. S. Pickles.

Dundee Sub-Centre.—Thursday, February 9th. University College, Dundee. 7.30 p.m. Discussion on "Non-Destructive Testing," to be opened by Mr. B. G. Churcher.

Association of Mining Electrical Engineers (*West Wales Branch*).—Saturday, February 4th. Swansea. Annual dinner.

South Wales Branch.—Saturday, February 11th. Queen's Hotel, Cardiff. Annual dinner.

Electrical Power Engineers' Association (*London Local Group*).—Tuesday, February 7th. Caxton Hall, Westminster, S.W.1. 7.15 p.m. "The Requirements of a Modern Meter Department," by Mr. J. L. Ferns.

Northern Division.—Wednesday, February 8th. Liverpool Engineering Society, The Temple, Dale Street, Liverpool. 7.30 p.m. "Electricity in Modern Aviation," by Mr. T. Hodge.

Institution of Heating and Ventilating Engineers.—Wednesday, February 8th. Park Lane Hotel, London, W. 6.30 for 7 p.m. Annual dinner.

Batti-Wallahs' Society.—Wednesday, February 8th. Hotel Victoria, Northumberland Avenue, W.C.2. 12.30 p.m. Luncheon to Sir Hal Colebatch.

Diesel Engine Users' Association.—Wednesday, February 8th. Caxton Hall, Westminster, S.W.1. 4.45 p.m. "The Design and Construction of Alternators for Coupling to Diesel Engines," by Messrs. F. Fitchett and W. R. Holland.

Acceleration and Reversal.

By F. E. Butcher, A.I.E.E.

The use of induction motors for heavy duties

THE majority of induction motors are required to start or stop only once in a while, and provided there is a reasonable margin of torque, starting performance is not of the same importance as it is where conditions necessitate frequent starting and stopping.

Single-speed lifts are commonly decelerated by mechanical means, but lifts driven by two-speed motors are usually decelerated by switching, in suitable steps, from the high-speed to the low-speed windings. In the latter case a large negative torque is developed when running on the low-speed winding at hypersynchronous speeds.

The criteria aimed at in the modern lift are speed and comfort. With sufficient power, speed is easily obtained, but with increased speed the higher acceleration and deceleration soon become objectionable as, while the human body can travel in a straight line at constant speed, rapid change of speed or direction causes discomfort. Change of speed is proportional to the applied force (after deducting friction) which, taken to its source, is the motor torque. Therefore, the torque during acceleration and deceleration should be maintained for as long as possible at the highest value consistent with comfort and the speed-torque curve should be as flat as practicable.

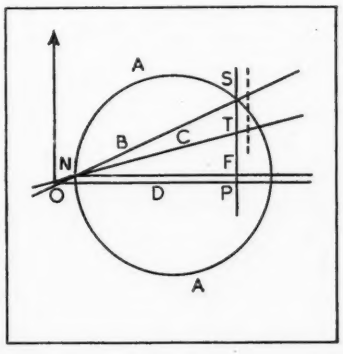


Fig. 1

Hydro-extractors provide an example of the difficulties involved in getting rid of heat, and the motor must be designed to develop the requisite starting torque with the minimum heat loss. With tapping machines, on the other hand, rapid reversal is needed. Rollers and catcher tables for sheet-metal rolling present a particularly arduous duty for an induction motor since as many as forty reversals per minute may be required, each reversal from full-speed ahead to full-speed astern taking 0.5 sec. or less—all in an ambient temperature of 110 deg. F.

Extending the ordinary field of the circle diagram, as in fig. 1, ON representing no-load current and OS short-circuit current, then ST is rotor loss, TF stator-copper loss, FP constant loss and SP total loss, all on short-circuit. Calling the locus of the end of the current vector A, the power line B, the torque or slip line C, and the base line D, then in vertical measurements AB represents output, AD input, AC torque, $\frac{AB}{AC}$ speed as a function of synchronous speed, and the points N and S the no-load and short-circuit conditions.

Producing the lines and moving along A from N to S, the speed is slowly falling until at S the machine is stationary. Continuing in the same direction the speed becomes negative, or the slip greater than unity, because AB has become a negative quantity whereas AC is still positive. Full speed in the reverse direction is obtained when actual speed equals synchronous speed (allowing for negative direction), *i.e.*, when actual speed equals slip. This condition is satisfied when BC=2 BA as shown by the dotted line.

Going back to the no-load condition and following the circle round to speeds above synchronous, one can see that the torque now becomes negative, because the height AC is negative owing to A now being below the line C. The condition of the machine at infinity RPM is represented at the point where the line C cuts the line A to the right of the diagram.

Now, bearing in mind that the height AC represents torque and that $\frac{AB}{AC} = \frac{\text{actual speed}}{\text{synchronous speed}}$; curves may be plotted showing current and torque up to or between any speeds required. Producing all the lines of the circle diagram in the straightforward way indicated is not academically correct due to distortion caused by relatively high rotor frequencies and their changing effect on the reactance of the machine. However, I have found from experience that this point can be ignored for ordinary working. The typical set of curves fig. 2 shows that the machine when running as a generator has the same kind of pull-out torque as it has when running as a motor.

When a motor operates under rapid and frequent reversals all parts subjected to the reversing stresses must be designed liberally and with a view to the elimination of points where slackness is likely to develop, *e.g.*, by the use of taper shafts for couplings and of welding instead of keying for the laminations. Another important point is the bracing of the rotor bars, end rings and stator windings and everything that is subjected to reversing stresses.

External load can be divided into two parts—friction and inertia. Friction with a hydro-extractor is mainly made up of windage loss, which is negligible at low speeds. As the object is to get the basket up to the higher speeds as quickly as possible, this loss is usually ignored in the preliminary calculations. This variable friction loss can, however, easily be allowed for.

The chain motors for rollers and catchers tables have an approximately constant value of external friction load. Friction loss assists retardation but hinders acceleration, whereas inertia load hinders both acceleration and deceleration. The time for acceleration, t, for a given motor is proportional to the total coupled, WR^2 (mass or inertia in lb. ft.^{2}) of motor plus load. If Ta = accelerating torque (average), then $t = \frac{WR^2 \times \text{change of } RPM}{308 \times T_a}$.

Now if the external WR^2 is relatively high, most of the torque will be required externally. Conversely if we assume no external load we can visualise a graded torque circuit. Taking the torque at the air gap as 100 per cent. of the developed torque, the torque at the line of contact between the rotor laminations and the spider is the same minus the torque required to change the speed of the active material in the rotor (*viz.*, the rotor core, bars and end rings) and so on until we get to the last point in the torque circuit.

These motors thus differ from ordinary motors in which, theoretically, all parts should be designed for the same torque. This point has practical value where the WR^2 of the motor must be kept down to the absolute minimum. Usually that of hydro motors need not be kept very low as the value is insignificant compared with the WR^2 of the loaded basket. Owing to the driving off of fluid the WR^2 of the loaded basket changes as it is run up to speed.

The heating of an induction motor during acceleration is roughly proportional to the connected WR^2 and the loss in a short-circuited rotor when accelerated from standstill is equal to the stored energy in the system at full speed, *i.e.*, loss = $.000231 \times WR^2 \times (RPM)^2 \times (S_1^2 - S_2^2)$ watt seconds where S_1 = initial and S_2 = final slip. The loss during reversal by plugging is four times that during acceleration only. This makes the problem correspondingly difficult for plugging duties. The approximate total loss in watt seconds of an induction motor during reversal is $K \times WR^2 \times RPM^2$, K being a constant varying from 0.0013 to 0.0025, depending on the type

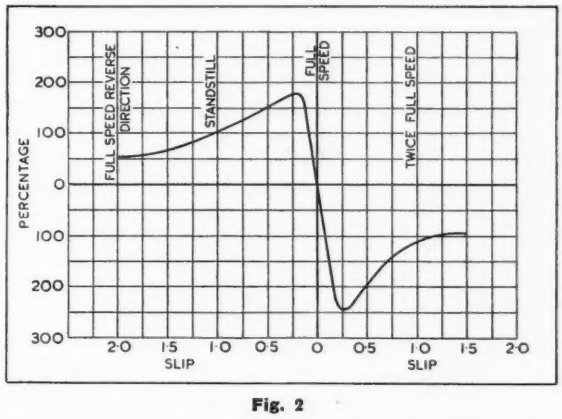


Fig. 2

of motor; for acceleration only K will range from 0.00032 to 0.0006.

Since this loss increases as the square of the speed, the speed must be kept as low as possible consistent with good performance. To avoid treating each separate gear every time, WR^2 figures can be referred to the motor speed in the ratio $\left(\frac{\text{speed of part}}{\text{motor speed}}\right)^2$.

The designer in order to calculate with a reasonable degree of accuracy must know: WR^2 of load; gear ratio of drive; value of friction load; and, if this is partly windage, the torque or horse-power at two or three speeds to enable him to separate the constant torque component from the variable torque component; time available for acceleration or reversal; number of

reversals or starts per minute; time machine is standing or running idle.

It is not always desirable to cut down the time available for reversal to an absolute minimum; for example when loose rolling (*i.e.*, rolling with several thicknesses of sheet at a time) if the chain motors for rollers and catchers tables are reversed too viciously the sheets will move relatively to one another and become scratched. In regard to two-speed AC lift-motors, control-gear makers have tackled their part of the problem so well that the excess braking torque generated when the motor is running at high speeds with the low-speed winding switched in is really not very important (see fig. 3), in which the dotted line shows the conditions when the motor is not required to start on the low-speed winding.

With hydro-extractors the method of procedure is first of all to superimpose the calculated speed-torque curve of the motor on the speed-torque curve of the load. Subtracting the latter from the former, the resulting curve shows the torque available for acceleration. Now split up this curve (fig. 4) along the speed base into about five parts and find the average torque for each, from which may be derived the time required to create the successive changes of speed which when added give the approximate total time for acceleration. More than five sections are, of course, taken in the final calculation.

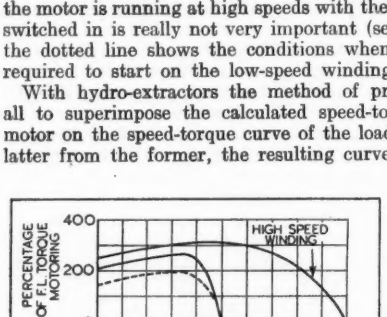


Fig. 3

If the accelerating time closely approximates to the required figure the next step is to check the heating by plotting speed-current and speed-time curves, and from these two to plot the time-current curve. Now extend this to cover the idling and standstill periods and then obtain the RMS current over the working day. Having found this, decide whether or no this figure is too high. Experience shows that with a suitable design of the squirrel-cage on hydro-extractors, if the stator

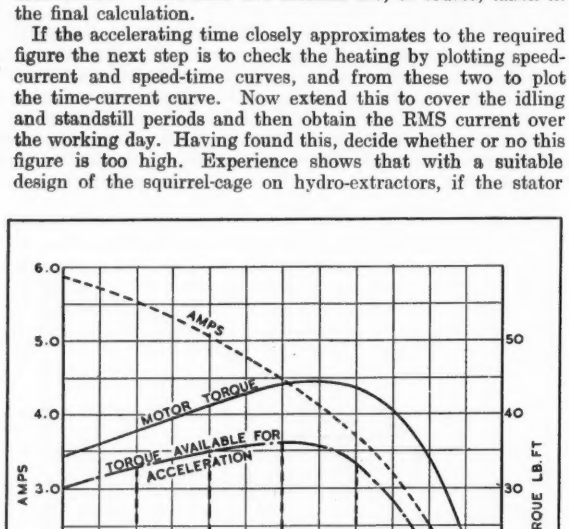


Fig. 4

RPM	0	50	100	150	200	250	285
Change of RPM	50	50	50	50	50	35	
Av. torque ...	31.5	34	35.5	35	27	11	
Time units ...	0.00535	0.0048	0.0046	0.00465	0.0061	0.01038	
Amps.	5.9	5.5	5.0	4.45	3.7	2.5	1.0

Time units can be expressed in seconds when WR^2 is known.

copper heating is satisfactory the rotor heating is also. However, RMS current is not the only factor. If high peak currents are allowed, only experience with the "heat inertia" of each motor can decide their effect. Even if the RMS current is satisfactory it is possible that the motor might burn out during the first start.

Without altering the size of motor the accelerating time can be varied over wide limits, and this can be done without altering the flux of the machine; *e.g.*, the curves in fig. 5 relate to three motors having the same stator characteristics, but different values of secondary or rotor resistance. It is the torque available for acceleration that counts, however, not the whole torque developed by the motor, especially for reversing duty. Motor No. 2 would accelerate a given WR^2 more rapidly than would Nos. 1 or 3, although not necessarily with the minimum temperature rise.

When a machine is fitted with a fan the effective cooling is reduced by the considerable periods of slow running and standstill. To provide for this a fairly safe rule is to allow for cooling whilst standing at half and whilst accelerating, decelerating at three-quarters of the running rate. When there is no ventilation the cooling of the machine is approximately constant at all speeds.

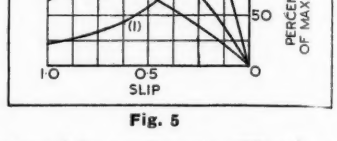


Fig. 5

With some hydros it is usual to insert a resistance in series with the stator in which case the speed-torque curve of the motor should take the shape of No. 3 rather than of No. 2 or No. 1, since it is desirable to maintain the torque at as constant a value as possible consistent with its requisite magnitude in order to get a high average. As the voltage across the motor at starting is lower than at high speeds the inherent torque at standstill has to be much higher than when no resistance is used.

For machines required for rapid and frequent reversal by plugging, a trial motor can be taken and its WR^2 reduced to the lowest possible figure. Its speed-torque curve from no-load speed to the same speed in the reverse direction can then be superimposed on the speed-torque curve of the load. As the last is usually a straight line at a fixed height from the base the torque available for reversing can be easily obtained (fig. 6).

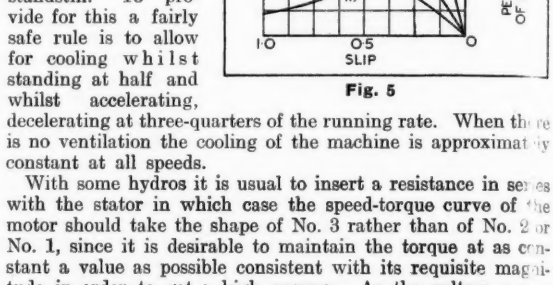


Fig. 6

By dividing this curve into several parts the time for reversal can be found as in the case of acceleration of the hydro-motor. The total of all the individual times represents reversing time. Speed of reversal can be adjusted to the proper value by flux adjustment or rotor resistance. The RMS current is dealt with in the same way as for the hydro-motor except that the times are shorter and the current goes up to the figure caused by plugging. This will show whether the stator copper heating is satisfactory.

Here again, in preliminary calculations, a safe stator value gives a safe rotor value especially as low inertia rotors have considerably more radiating surface than standard ones. For very short periods the rotor frequency is twice the stator frequency, but in practice this may be ignored. The rotor reversing loss can be obtained by the formula given earlier. The number of watt-seconds per minute can be averaged and restated as plain watts and it can then be decided if the machine is likely to be satisfactory.

Errata

Owing to a printer's error the inscription to fig. 3 of the article on "Luminous-tube Interior Lighting" in our last issue (p. 123) was incorrectly given. It should have read "Fig. 3.—Typical arrangement of triple-tube circuit."

In the article on "Low-voltage Short-circuit Values," by R. T. Lythall, published in the same issue (p. 118) the value 10^5 should read 10^{-5}.

Electronic and Scanning Microscopes

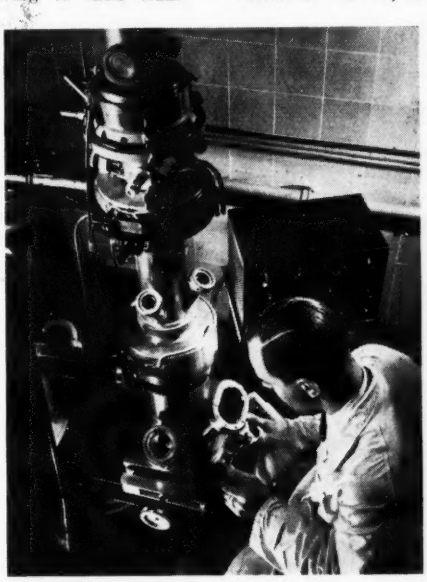
By A. Stäger (Switzerland)

OUR electrical knowledge is mainly based on our knowledge of the electron, but many electrical phenomena may be understood without going very deeply into physics. In explaining the principle of the electronic microscope we need take into account only the following five facts: (1) The electron has a negative charge and may be accelerated by an electrical pressure; cathode-rays or electronic rays within a vacuum tube are generated in this way. (2) Cathode-rays travel in straight lines if they are not deflected by any forces. (3) Cathode-rays may be deflected by electrical fields as, for instance, in cathode-ray oscillographs or television tubes. (4) Electronic rays constitute, owing to their transmission of electricity, electrical currents; they may, therefore, be deflected by magnetic fields according to the well-known hand-rule. (5) If fast electrons strike a screen made of luminescent substances they produce a light spot.

In fig. 1 L_1 and L_2 represent perforated rings. If they be connected to a source of DC (*e.g.*, a battery) the surfaces of equal potential expand outside the hole like compressed rubber sheets, forming a non-homogeneous electric field. This acts as an electrical lens, corresponding to a glass lens in light optics.

Cathode-rays emitted from the glowing filament G in the direction of the lens axis (dotted line) are not diverted; but all oblique rays emitted from G as a divergent beam are refracted by the electrical lens as light rays are refracted by a magnifying glass.

Therefore, the electrical lens projects the glowing filament G on to the luminescent screen B, where an enlarged image of the filament is produced upside down.



The electronic microscope

Although a microscope with electrical lenses can, and has been, constructed, it may be emphasised that magnetic lenses produce a higher magnifying power. The principle of the magnetic lens is illustrated in fig. 2. Suppose that inside a vacuum tube a beam of parallel or diverging electronic rays E were moving from left to right. M represents the cross-section of a DC coil. The non-homogeneous magnetic field, represented by dotted lines, acts as a concentrating lens, and the electronic beams are focused at F. The crucial experiment can easily be shown with any cathode-ray tube. If the coil is put outside the tube and supplied with a slowly increasing current the light spot on the luminescent screen gradually becomes smaller and, for a certain number of amperes, is found to form a very distinct focus.

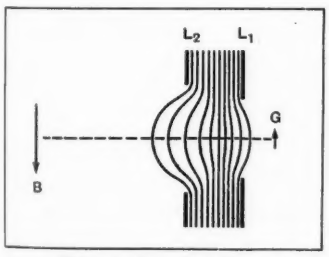


Fig. 1.—Electrical lens

Magnetic and electrical lenses have no constant focal length; they depend upon the speed of the cathode-rays and the intensity of the magnetic or electric field.

In electronic optics the same law is valid as in ordinary optics, namely, the formula: $1/g+1/b=1/f$, where g=distance of object from magnifying lens, b=distance of image from lens and f=focal length. The theory of electronic optics was evolved by H. Busch in 1926 and important research work concerning the electronic microscope has been performed in the laboratories of the A.E.G. at Berlin and of the Technische Hochschule Charlottenburg - Berlin by Knoll, Ruska, Schulze and Brüche.

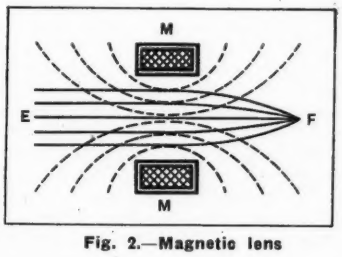


Fig. 2.—Magnetic lens

Although the nature of the radiation and of the lenses of the electronic microscope is quite different from that of the light microscope in principle, the geometrical arrangement of the rays is identical. An object lens produces an enlarged image of the object and an eyepiece is used for examining it or projecting it on to a screen.

The condenser lens is of secondary importance, as it is required only for the illumination of the object. In the electronic microscope all three lenses can be represented by magnetic fields. Fig. 3 shows the magnetic object lens O and the projecting lens P. The third lens, *i.e.*, the magnetic condenser lens C, is covered by the metallic walls of the vacuum tube. The object to be examined must be brought inside the vacuum tube and must be extremely thin and partially transparent for fast electrons. The luminescent screen or the photographic film or plate L must also be within the vacuum tube. The enlarged image on the screen can be examined through the tubes T.

Recently the latest form of the electronic microscope has been publicly demonstrated by Siemens & Halske. In this the magnet coils are shielded with iron except for a narrow slot (fig. 4). This construction forces the magnetic flux to concentrate near the poles and ensures a very strong non-homogeneous field, *i.e.*, a lens of a very short focal length. By means of special locks objects and luminescent screen or photographic plate can be exchanged without spoiling the vacuum, the manipulations taking only from one to two minutes.

The object is held by a thin collodium layer, the thickness of both not exceeding 5×10^{-5} mm. Adjustment is made by regulating the anode voltage of the cathode-ray tube (about 80,000) and the DC of the lens coils.

For the light microscope the minimum distance of two points which can be recognised individually is approximately identical with the half-wave length of light, *i.e.*, 0.4 to 0.2 micron for visible light. With ultra-violet rays the limit can be extended a little. The ultra-microscope which uses oblique illumination makes visible colloid particles of submicroscopic size, without, however, depicting their true form. The light microscope reaches its resolving limit at 1.6×10^{-4} mm. and its maximum magnifying power is about 2,000.

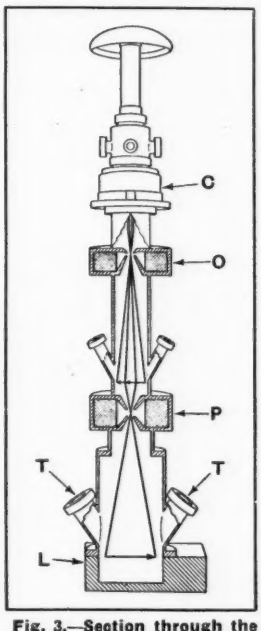


Fig. 3.—Section through the electronic microscope
C, magnetic condenser. O, object lens coil. P, projecting lens coil. L, luminescent screen or photographic plate. T, tubes for examining the enlarged image.

According to E. Schrödinger's wave mechanics* electrons are wave systems, the wave-length of which decreases with increasing anode voltage, *i.e.*, with increasing speed of the cathode-ray particles. At 75,000 V electrons are obtained with a wave-length of 5×10^{-9} mm., *i.e.*, 0.00001 times the wave-length of visible light. The resolving and magnifying power of the electronic microscope are, however, not proportionally greater than those of the light microscope, M. v. Ardenne†, states that, theoretically, the electronic microscope will permit a maximum resolving power of 10^{-9} mm. The maximum magnification may reach or even exceed 100,000.

Although the full theoretical possibilities are not yet exhausted, to-day enlargements up to 30,000 and even more are

* See, for instance: "An outline of Wave Mechanics," by N. F. Mott, Cambridge University Press.

† M. v. Ardenne, "Zeitschrift für Physik." Vol. 108, 1938.

reached, *i.e.*, the magnifying power is fifteen times that of the light microscope. With electronic rays we do not see colours or transparency for visible light, but *mass distribution*, *i.e.*, a similar structure of the object would be obtained with soft X-rays.

In the accompanying illustrations of magnified bacteria it is seen that in spite of the considerable enlargment with the electronic microscope the outlines are very distinct and there are differences of shadow points and lines in the vicinity which are not visible with the light microscope.

With the electronic microscope as described only extremely thin objects can be examined, and these must be put into the vacuum space of the tube. Recently M.v. Ardenne has obtained practical results with what is known as a "scanning microscope," which involves a fundamentally new principle in microscopy, recalling tele-cinema technique.

Left: Diphtheria bacteria photographed through a light microscope with a magnification of 1,000 and afterwards enlarged seven times. Right: Single diphtheria bacterium enlarged 18,900 times with the electronic microscope

This instrument makes use of two magnetic lenses for producing a minimised image of an electronic source (glowing filament or diaphragm, which is illuminated with electrons). A narrow cathode-ray beam passes crossed deflector-plates and is given the movement for scanning a surface, in this case the tiny object to be enlarged. The intensity of the electron current issuing from the object depends upon the transparency of the object for electrons at the scanned point. The issuing electrons may be gathered with a collecting electrode which is connected to the grid of an amplifying valve. The amplified voltage can be used to control the intensity of the electronic beam of another cathode-ray tube, *e.g.*, a television tube. The scanning movements must be synchronised in both cathode-ray tubes.

Unlike the electronic microscope this method eliminates the undesired influence of electrons with varying speeds. Also the scattering of electrons in relatively thick objects is of less importance, so that such objects can be examined. Furthermore, the scanning electron beam can be liberated from the vacuum tube by using a thin window of a substance of small absorption power. In this case even living cellules which are outside the tube in the atmosphere at ordinary pressure can be scanned and magnified.

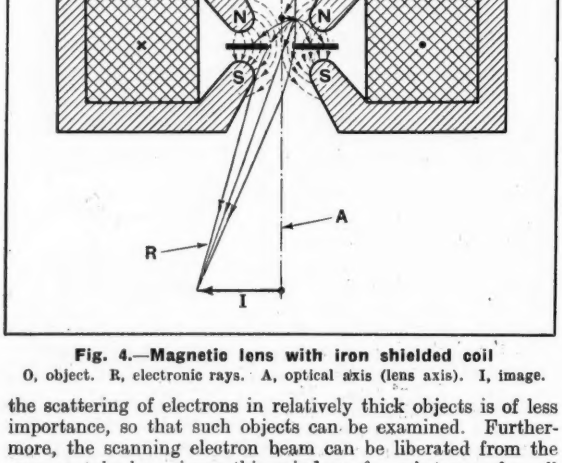


Fig. 4.—Magnetic lens with iron shielded coil
O, object. R, electronic rays. A, optical axis (lens axis). I, image.

Electricity in New Zealand

Rapid development taxes power resources

THE annual report on hydro-electric development in New Zealand published by the Government is actually a comprehensive survey of electricity supply in the Dominion, where the principal generating plants are the water-power systems of the Public Works Department. At March 31st last the main plants (all water power) which the P.W.D. operates had a total capacity of 238,560 kW, its steam standby plants amounting to 12,110 kW. In addition, a number of power boards, local authorities and companies operate main plants (mostly water power) with a total capacity of 41,350 kW and standby plants (mostly steam) aggregating 87,228 kW, making the totals for all authorities 279,910 kW (main) and 99,338 kW (standby).

Altogether 1,250 million kWh was generated during the year (1,237 million kWh by hydro-electric plants), of which the Government systems were responsible for 1,073 million kWh. This represented an increase of approximately 16 per cent. during the year. Sales to consumers amounted to 978 million kWh, giving the high averages of 659 kWh per head of the population and 2,518 kWh per consumer, of whom there were 388,580 at the end of March (equivalent to 24.4 per cent. of the total population), against 371,027 a year before.

It is interesting to note that the maximum demand per head of the population now exceeds the 0.15 kW which was the basis of the design of the Government schemes. The total connected load at the end of March was 1,676,689 kW, an increase of 13.5 per cent. during the year. Domestic load building was even more active than before. The number of electric cookers connected increased by nearly 21 per cent. to 64,408 and the water heaters by 15 per cent. to 77,353, and in both cases the number of connections was greater than in any previous year. There was also a large addition (12 per cent.) to the number of electrically driven milking machines in operation, making the total 22,711.

So rapid has been recent electrical expansion in the Dominion that fears have been expressed at the adequacy of the power resources. To meet the increasing demand the P.W.D. has recently installed two additional 21,000-kW units at Arapuni, and a start has been made on a new development of 40,000 kW below the existing station at Waikaremoana, where a further 20,000-kW unit has just been installed. In the South Island two new 15,000-kW units are being installed at Waitaki, and surveys have been carried out with a view to further power schemes on the Waikato River.

An important transmission project on which work is proceeding is the West Coast electrification scheme in which the line crosses the Southern Alps (see illustration on page 176). The total length of transmission and distribution lines in service at the end of March was 24,407 route miles, an increase of 1,085 miles during the year, the number of consumers per route-mile of line being approximately sixteen.

The report of the chief electrical engineer to the P.W.D. (Mr. F. T. M. Kissel, B.Sc.) which is included in the comprehensive volume, gives some interesting information on the regulations in force in the Dominion. The Electrical Wiremen's Registration Act makes registration compulsory and under an amendment to the Act it is mandatory to give notice of the installation of private electrical plants, which are inspected before they are placed in service. The extent of control exercised over electrical work is indicated by prosecutions during last year, which were for such offences as permitting unregistered persons to work, connecting washing machine to supply without permission, failing to notify supply authority of start and completion of work, earthing a radio set to a gas pipe, using an unearthed metal-covered switch, and installing a radio set which did not comply with the regulations.

During the year fewer people were involved in electrical accidents than in the previous two years, despite rapid development. Altogether there were 42 accidents (49 in 1936-37) of which nine (eleven) were fatal.

Artificial Lighting. By G. V. Downer

The advantages of indirect systems

UNDER modern civilised conditions, including both our industrial or business activities and our recreations and home lives, artificial lighting plays so important a part that it is becoming increasingly desirable for as many people as possible to have some idea of the nature of light and the essentials of good illumination. This will enable them to think for themselves sufficiently to insist on satisfactory lighting and be able to recognise it when they have got it and when not, rather than, as so frequently happens, taking it for granted and accepting any sort of haphazard arrangement of bulbs and shades that they may find in use or that may be inflicted on them by equally indifferent contractors or landlords. The result of such indifference is usually that their efficiency and comfort are considerably and unnecessarily below par, with sometimes the more serious consequence of ultimate injury to eyesight.

In order to approach lighting problems in a realistic and intelligent manner, it is essential to keep clearly in mind the primary purpose of all lighting, that is, of course, to enable us to see the whole of our surroundings, or the particular objects illuminated, as clearly and easily as possible, without glare or discomfort, or any risk of eye-strain and with due regard to economy. Although this may seem obvious it often appears to be overlooked nevertheless, as, for instance, when bright naked lights are used to attract the eye to some display. This, however, largely defeats its own object, since the dazzling effect of the lights often makes it difficult for the observer to see the display itself in comfort. The object of lighting is not to attract attention to the number or brilliance of the lamps or to the lighting fittings, which being only a means to an end should usually be as inconspicuous as possible.

The author states that with well-diffused, evenly distributed, glareless and shadowless artificial light one foot-candle would probably be found enough for nearly all purposes, but to allow an ample margin he usually advocates 4-5 foot-candles under average conditions. He considers that high intensities are undesirable.

Another point that is often not realised by the public is that we cannot see light itself, but only objects from which it proceeds. Light itself is an intangible and invisible form of radiant energy, differing only from heat and wireless waves in its wavelength. Normally we do not want to see sources of light; the only exception is when the source of light is used decoratively or is intended to call attention to itself, as in luminous signs, traffic lights, &c., and not to illuminate the surroundings. In such cases the intensity is much less than it would have to be for illuminating purposes. Apart from these, all our normal surroundings are non-luminous and we can see them only by means of the light which they reflect towards us, and which varies according to the nature of each object. Thus when blue light or any light which includes blue rays falls on a "blue" object, for instance, it reflects the blue rays and appears blue, while if only red light falls on the object it is unable to reflect any of it and appears black.

Lesson from Natural Lighting

Since practically all visibility depends on the reflection of light we must enable light to reach every part of every object. All the various shapes, tones, colours and textures in nature are visible because light reaches every object from all directions, *i.e.*, from all parts of the sky, owing to the reflection and refraction of the sun's light by innumerable minute particles of moisture or dust in the atmosphere, so that when the sun is obscured the illumination is practically even on all sides, and when the sun is shining there is still plenty of generally diffused light to illuminate the shadows. Hence, if we would achieve an equally good visibility of our surroundings by artificial light we should aim at a similarly well diffused and evenly distributed illumination.

Direct light shining in our eyes from the source contributes nothing to the visibility of our surroundings, since it has not been reflected by any object, but, on the contrary, being brighter than the useful reflected light from surfaces, it makes the latter seem less bright by contrast. The direct light also causes the iris of the eye to close up in self-protection against the glare and therefore the eye admits less of the useful reflected light from surroundings and thus doubly reduces their visibility. Hence indirect lighting, in which the source is concealed from the eye and all the light is directed on to surrounding objects by reflection, is more effective, comfortable and preferable in every way to direct lighting for practically all purposes. Indirect lighting will also give better visibility with less actual intensity, owing to the freedom from glare which allows the iris to remain fully open, thus admitting all the light coming from surrounding objects, so that the light has its full effect instead of being partly wasted.

Another advantage of indirect lighting is the absence of noticeable shadows, *i.e.*, unilluminated or poorly illuminated areas—it is difficult to see clearly either the shadow side of an object or any other object on which the shadow falls. Moreover, where there are a number of direct light sources there will be a corresponding number of shadows to each object, and again, where there is much movement of persons or machinery, the moving shadows are liable to be peculiarly irritating and confusing to the eye.

With regard to the intensity required, this will depend on the reflecting properties of the objects present and of walls, ceilings, &c., for since objects are only seen by the light which they reflect, obviously dark objects will require more light to make them clearly visible than light objects which reflect most of the light falling on them. For average cases, however, the amount of light required is considerably less than is commonly supposed and usually advocated by lighting engineers. We have only to consider how late we can often see to read or play games after sunset before needing artificial light, and how much more brilliant the latter appears, when we first switch it on, than the daylight which a short time previously was quite adequate, to realise that if we could distribute our artificial light as effectively as daylight we should need far less than we generally use at present. Daylight varies over an enormous range of intensities twice daily, and we can see almost equally well at all intensities from several thousands of foot-candles down to about ¼ foot-candle or even less.

Average Requirements

With a similarly well-diffused, evenly distributed, glareless and shadowless system of artificial lighting we should probably find 1 ft.-candle enough for nearly all purposes, but to allow an ample margin I usually advocate about 4 or 5 ft.-candles for most purposes and under average conditions. Yet we often see intensities of 10, 15, 20 and even 50 or more ft.-candles recommended, although such high intensities are obviously unnecessary and therefore uneconomical. They are also almost certainly dangerous to eyesight, owing to the unnatural quality of artificial light, which even if "corrected" to resemble the colour of daylight as closely as possible (and still more if not), necessarily differs very considerably in its constitution from daylight, to which our eyes are adapted by nature.

Imagine one foot-candle, *i.e.*, the light given by a candle at a distance of one foot, provided at every point in a room wherever we turn, the candles all being shielded from direct view so that there is no glare and also that there are no shadows. Would not such a light be ample for most purposes? Our ancestors frequently did fine work by the light of a single candle and preserved their sight to an advanced age without glasses. Yet I am proposing to use 400 to 500 per cent. more than in the above illustration. Surely to go much beyond this is dangerously excessive.

Question of Cost

Indirect lighting is often thought to involve prohibitive running costs, owing to the enormous number of bulbs and very high energy consumption with the older methods. This objection, however, no longer applies, as with up-to-date methods the number of bulbs and energy consumption required need only be a fraction of what they used to be, while even the cost of installation is seldom more and often less than with the older methods. The correct use of reflectors designed to make the fullest and most effective use of all the light given out by each lamp enables a minimum number of lamps with minimum energy consumption to be used, the light from each being evenly distributed over a maximum effective area while the lamp itself is concealed. These principles can be applied to all types of lighting device, such as laylights, cornice lighting, panel and beam lighting, artificial windows, ceiling boxes and indirect pendants, brackets or standards, all of which can be designed so as to harmonise in appearance with any particular architectural style or decorative scheme.

We all come under the influence of artificial light for a considerable part of our working hours and the quality of the lighting will necessarily affect our efficiency and our health and eyesight. The use of glasses appears to be steadily increasing; the general standard of eyesight has certainly deteriorated with the increasing use of artificial light, and if we are to retain our present standards of sight or better still regain some of our lost powers, we must cease to take artificial lighting for granted but must endeavour to treat the subject in a more intelligent manner than hitherto.

Meetings and Discussions

In a recent E.P.E.A. paper the view was expressed that the power station chemist and engineer should be two separate individuals each with authority to decide for himself in his own sphere. Some interesting apparatus in use at the B.B.C. Empire Station at Daventry was described in last night's I.E.E. paper, and in a Wireless Section paper on Wednesday recent advances in the manufacture of electrolytic condensers were outlined.

The Power Station Chemist

A FEW of the diverse duties of the chemist in a modern power station were discussed in a paper presented to the London Local Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION in London on January 24th by Mr. G. W. Hewson and Mr. R. Ll. Rees. It was pointed out that analysis, which provided the measurement needed for watching and controlling processes, was as important to the chemist as instruments were to the engineer. The results of analysis were not always easy to interpret, and considerable experience was sometimes needed to judge their meaning correctly, as was shown by a number of the authors' examples.

Admittedly it was possible in theory, said the authors, to train a chemical engineer to combine the ability and experience needed, first, to understand the chemistry of the process and to interpret and apply the analyst's reports; and, secondly, to supervise the engineering features of operation and maintenance. He would certainly be a superman, not only because of varied attainments, but because the mental outlooks were very different, and must be so if each were to fulfil his functions in the best and most expeditious manner. That was one of the several cogent reasons why unified control of that kind would be a hazardous undertaking, especially in the larger power stations. It was much better in those circumstances that the chemist and engineer should be separate individuals, each with authority to decide for himself in his own sphere. The closest co-operation between them was essential; therefore, each must know something of the other's subject and appreciate the other's point of view.

Coal Sampling

Discussing modern methods of coal sampling, it seemed that the "probable error" of the whole process of determining the calorific value of a consignment of coal was approximately ± 0.25 per cent. when the greatest care was taken; there was a corresponding chance of about 100 to 1 that the result would be within ± 1 per cent. of the true value of the consignment. That appeared to be the highest degree of precision that could be expected in careful industrial work. In connection with the chemical aspects of the combustion of coal on mechanical stokers, stress was laid on the desirability of using secondary air and the need for careful supervision of the composition of the flue gases.

Care in the operation of a properly designed closed-feed system would avoid the need for continuous addition of chemicals and thus, by virtue of very low concentrations, to evade trouble from carry-over, and to save heat that would otherwise be lost in blow-down, which might amount to 0.5 per cent. of the heat in the coal fired. Constant attention to detail was essential with that method of operation, which had been used successfully in plant working at 600 lb. per sq. in. pressure, the pH of the feed water being 7.3, its oxygen content 0.01 c.c. per litre or less, and its specific conductivity about 0.5 "Dionic" unit.

It was impossible to treat the water in a group of boilers properly by adding reagents to a feed line common to them all; each boiler needed individual treatment. Everything possible should be done to delay the start of corrosion, particularly in the early days of a boiler's life, when there was a temptation to relax the meticulous care that was usually bestowed on modern plant. The trying conditions of nightly banking and frequent outage, from which high-pressure boilers might be expected to suffer most, required serious consideration.

Damping Fuel

In the discussion the chairman (Mr. L. Morton) expressed the opinion that the number of air paths under control on the stoker had a distinct bearing on the amount of secondary air necessary. Concerning fuel damping, for which the authors had made out an excellent case, he said that the evaporation of the moisture, with consequent increase of egress paths through the fuel, made possible a reduction of excess air, better ash conditions and higher furnace efficiencies, with very considerable reductions in maintenance costs. One large power company, as the result of a keen study of the problem, had added 150 tons of water to the 1,500 tons of fuel used daily. Spray damping equipment was fitted over the horizontal run of the conveyor buckets.

Mr. Rees said he imagined that the best position for wetting coal would be as early as possible in its travel; the bucket conveyor was a good place. It would be well to control combustion by the percentage of unburnt gases, but he did not know of any instrument which was effective for that purpose; one needed to know percentages within about 0.02 in order to do that.

Need for More Chemists

Dr. W. Francis said that he knew of no industry of comparable size with the electricity generating industry in which fewer chemists were employed or in which the status of the chemist was so low; properly trained chemists with initiative and experience invariably paid their way. Training facilities for power station chemists were not looked after very well in this country, and the only university he knew of which catered for such men was Sheffield, where there was a course in fuel technology. The alternative was to employ a man with an ordinary degree in science; but such a man would require a large amount of practical experience before he could pull his weight. Further, this country was very badly off for technical journals that discussed in detail the problems which power station chemists had to face; they did not compare with some of the American journals. There had been a very general tendency for the industry to rely on the laboratories of outside contractors and consultants for advice, which was a retrograde step. The Central Electricity Board was equally guilty in that respect, because it had no chemists on its staff; it simply farmed out its problems. There was no organisation to look after the interests and welfare of power station chemists particularly, and he suggested there was room for a chemical section inside the Electrical Power Engineers' Association.

Mr. G. M. S. Sichel asked for the authors' opinion on the "bleeding" of the internal surfaces of steam pipes and steam drums generally. He mentioned a large turbine installed some years ago in which at first the high pressure end was coated with a dark red oxide, which had subsequently travelled towards the exhaust end, and the high pressure end had assumed a dull blue colour. Mr. Rees replied that possibly fabrication scale played some part in that particular trouble.

Mr. J. M. Edmonds said that there were some very excellent evening classes at the Northern Polytechnic, London, covering fuel technology, and extending over two or three years. That organisation seemed to specialise in power station chemistry.

In reply to Mr. S. E. Nodes the author said that the correct temperature for secondary air was largely a matter of trial and error. At present secondary air was used at the same temperature as the primary air. Dr. R. Pendennis Wallis pointed out that the agglomeration temperature of the ash had an effect on the upper limit of the secondary air temperature; if it were too high, "bird-nesting" would occur because the ash would stick on the tubes.

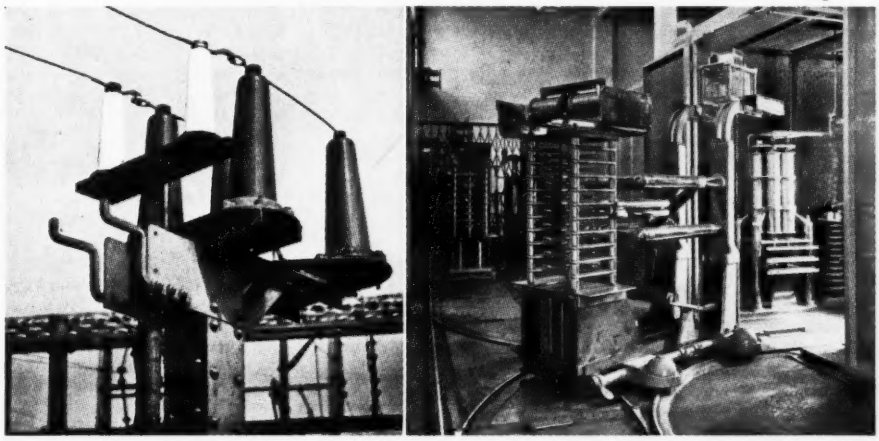
B.B.C. Empire Services

EMPIRE broadcasting as conducted from the short-wave transmitting station at Daventry, covering practically the whole world, was reviewed in the paper by Messrs. L. W. Hayes and B. N. MacLarty (B.B.C. staff) that was read at the INSTITUTION OF ELECTRICAL ENGINEERS in London on February 2nd.

A historical beginning and accounts of experimental development were followed by considerations underlying the design of the present station, together with details of the changes made in the aerial system, plant installed and performance. It was pointed out that the gain in signal obtained by power increase at the transmitter had been aptly termed "gold-plated" decibels since it did not depend on propagation conditions as did the gain obtained by change in aerial design. In a service which worked for many hours a day, it was an expensive method of obtaining gain, and from this point of view it should be the last resort. But in a short-wave broadcast service it was impossible to count on gain of receiving aerials or on too great an increase in gain by limiting the width of the transmitted beam by suitable design of the transmitting aerial.

Other methods of obtaining an improved signal-to-noise ratio, such as the use of single-sideband transmission with suppressed or partially suppressed carrier, were also denied to the broadcast engineer, at least in the present state of the art. He was therefore forced to use the highest possible power. Even then he could not hope to provide as good a ratio in disturbed conditions as was desirable for good broadcast transmission, which demanded a ratio of about 40 db. Considering only the gain of a specially designed receiving aerial, 15 db could be fairly easily obtained in comparison with an average listener's aerial. This represented a power ratio of 32 to 1 or 320 kW at the transmitter in place of 10 kW.

In 1935 the highest-power short-wave broadcast transmitter commercially available was not capable of delivering more than 50 kW to the feeder on the medium and longer short waves. This was not considered sufficient for the future. Consequently, the transmitter supplied by Marconi's Wireless Telegraph Co., Ltd., was designed for a maximum unmodulated output to the aerial feeder of 100 kW at wavelengths between 70 and 80 m., and 75 kW at 13.5 m., rising to 100 kW at 30 m., the modulators being in series with the main high frequency amplifier. Wave-change was effected by means of circuits mounted in trucks, one truck being provided for each of the four wave channels on which it was desired to operate the transmitter. This system was applied to the three final high-frequency amplifiers.



Left: Constructional details of the hook feeder-aerial switch on post type insulators used at Daventry. Right: Typical circuit truck of Marconi transmitter

The circuits of the low-power amplifiers and harmonic generators were preset, a separate set of equipment being furnished for each of the four working wavelengths.

The circuit trucks travelled on rail tracks with sidings to facilitate interchange by pushing them in and out of cubicles. Hydraulic rams used to control anode tuning, feeder coupling and balancing condenser adjustments were actuated by a Lockheed master cylinder operated by a hand-wheel at the front. This was believed to be the first occasion on which hydraulic control, which was considered to have many advantages, had been employed for controlling variables in a wireless transmitter.

Two transmitters supplied by Standard Telephones & Cables, Ltd., were designed for a maximum unmodulated output to the aerial feeder of 80 kW at wavelengths between 30 and 80 m., and 52 kW at 13.5 m., rising to 80 kW at 30 m., "Class B" modulation being effected at the anodes of the main high-frequency amplifier. Wave change was carried out by means of circuits mounted on turntables, enabling spare valves to be provided, which was an achievement in plant of this power and wavelength.

The turntable system was applied to the penultimate and main high-frequency amplifiers, the coupling between which was of unusual interest, since the grids of the main amplifier were earthed and the filaments insulated, the exciting circuit being connected between them. The transmitters at present installed were not being worked at their full power, but only at the value for which the Daventry station was licensed by the Postmaster-General, namely, 50 kW delivered to the aerials. The higher available power constituted a reserve.

The Empire scheme involved the provision of 25 aerials and six transmitters. Therefore, the use of open-wire coupling feeders simplified considerably the switching system. A feeder-aerial switch on post type insulators that was simple and cheap carried 15 A through a bronze shackle at one end and a hook at the other without a single case of bad contact being reported; heating did not occur at those contacts.

The necessity for driving several transmitters at the same carrier frequency made the centralisation of crystal oscillators and harmonic generators almost essential. There had been concentrated in one room eleven crystals in duplicate, two variable frequency oscillators and ten fixed and two variable harmonic generators, with provision for the addition of four more, all arranged for connection to the transmitters by cables and selector switchboards.

Power for the 14,000/22,000-V anodes was obtained from 400-kW steel tank mercury rectifiers. The filament, grid bias and auxiliary anode circuits were energised by motor-generators in duplicate, which were remotely controlled. Electricity was supplied by the Northampton Electric Light and Power Co., Ltd., through a ring main, two outdoor 2,500-kVA transformers stepping down from 11,000 to 415 V, three-phase, 50 cycles, and conveyed by two 4,000-A feeders, the switchgear rupturing capacity being 250,000 kVA. There were two 500-kW standby Diesel generating sets.

Two additional transmitters had been ordered for foreign language broadcasts, similar to the existing Marconi plant, except that modulation was to be of the "Class B" type. Additional rectifiers, motor-generators, extra aerials (Nos. 26 to 30) and another mast, with additions to the feeders and feeder-switching frame (which is a lattice-steel structure resembling an outdoor sub-station) were now being provided.

Electrolytic Condensers

ALUMINIUM electrolytic condensers were the subject of a paper by Mr. P. R. Coursey (Dubilier Condenser Co., Ltd.), and Mr. S. N. Ray (Borough Polytechnic) which was read before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on February 1st.

The authors stated that this type of condenser had come into general use during the last decade chiefly for electrical, especially radio, requirements. Considerations of cost, size and constancy favoured the use of aluminium in preference to certain other metals, but clean metal was not used; a dielectric oxide film was preformed on its surfaces by electrolysis. Improved means of effecting this process constituted the major portion of recent advances in manufacturing methods.

The authors expressed the opinion that a theory of operation based on the solid film alone was inadequate. Godsey had more recently put forward a theory that the normal film was of a greater total thickness than the effective film, the latter maintaining itself in repair by new growth wherever leakage currents flowed. Water or other solvents from the electrolyte saturated the film and so increased the effective capacity (water having a dielectric constant of about 80). A high dielectric constant kept the film sufficiently thick to reduce materially the voltage gradients.

The three types were generally known as the wet or aqueous, semi-dry and dry or hard dry. In all cases some preformation of the dielectric was carried out before assembly, followed by a final formation and/or ageing processes on the complete condenser, and often also on the individual sections which were built up in the case of a condenser "block." When etching or other processing was employed to increase the capacity for a given bulk of condenser, this must precede the preforming.

The sequence of commercial manufacture was outlined and was illustrated by means of a cinematograph film. This had been taken partly in the United States and partly in this country and was intended not so much to give information about an exact sequence of any one manufacturer as to be indicative of the various alternatives employed in various factories.

Dealing with the properties of electrolytic condensers, the authors stated that although various methods of synthesising the dielectric film on the aluminium anode were employed, its dielectric constant was not altered thereby to any very great extent. Only the physical dimensions of the dielectric were of importance to determine the condenser capacitance. The area of the dielectric was fundamentally controlled by the surface area of the electrode, and by virtue of the intimate or atomic attachment between them appropriate distortion of that surface (before formation) could increase its effective electrical surface

area, without increasing its overall dimensions. For the type of condenser generally used in radio receivers only one such electrode needed to be so treated. For the non-polarised type, both electrodes must be treated and must normally have similar effective areas. While a maximum increase of about ten times was possible, it was seldom that this full amount was used, and the higher voltage condensers constructed in this way were more often given an increase of from three to five times the normal. The many different methods used to increase the surface area were divisible into mechanical, chemical and electro-chemical.

Variation of leakage with duration of applied voltage, known as the reforming characteristic, constituted one of the most important characteristics and was a direct measure of the stability of the dielectric film. The uniformity of the reforming characteristic over a long period was a measure of the "shelf-life" of the condenser.

Probable Service Life

It was very difficult to generalise about the probable service life of an electrolytic condenser. In suitable use it should be at least two years, and was often very much longer. Apart from deterioration of the electrolyte, two other factors that might contribute to loss of capacity were clogging up of the porous positive film either by a deposit of crystals or precipitates from the electrolyte, or by aluminium salts in the colloidal state.

A demonstration during the presentation of the paper illustrated the electrical differences between the various types of electrolytic condensers, their relative sizes and the utility of different forms for use in the circuits of radio receivers. The compromise in size achieved by the use of a "surge-proof" type of condenser was well shown in this way.

The authors stated that for limiting voltage rise in a rectifier circuit with poor regulation wet electrolytic condensers were used. Their operation depended on the fact that the DC leakage increased rapidly as the voltage was raised above normal. If it was raised far enough there might even be sparking at the anode. On reducing the voltage to normal the condenser should function again in the normal way owing to the self-healing properties of the film. For starting split-phase single-phase AC motors electrolytic condensers of the non-polarised type were finding increasing use.

The paper embodied the results of research carried out by the Dubilier Condenser Co. (1925), Ltd., but included also data regarding other makes, such as the Telegraph Condenser Co. The demonstrations were arranged by the Dubilier laboratory staff.

In an appendix to the paper the authors set out details of a standard testing specification for all types of electrolytic condensers. The general use of such a standard method would not only simplify the manufacturing problems of the condenser maker, but would also tend to greater uniformity from the users' point of view, and doubtless ultimately lead to reduced costs of production.

Planning a Lighting Scheme

THE relation between the illuminating engineer and the designer of lighting fittings was the subject debated by the Decorative Lighting Section of the ILLUMINATING ENGINEERING SOCIETY in London on January 24th.

Mr. Harold Bright opened the discussion with a commentary, illustrated with many lantern slides, commencing at the stage at which an inquiry reached the illuminating engineer, whose chief concern was the adequacy and efficiency of the installation; either direct from the client or through the latter's architect, who had to preserve a sense of balance between decorative features and achieve unity in the whole. The fittings designed developed the ideas of those three into concrete form for the production of an article of commerce.

With that outline of their functions in mind, Mr. Bright proceeded to comment on how they worked together in practice, endeavouring to indicate that the illuminating engineer should be a liaison officer between the architect and fittings designer. If one or more of the three were missing the scheme could not be completely successful.

There certainly appeared to be an opening for illumination consultants who were prepared to work in collaboration with fittings designers, not in any way to supersede them or to offer destructive criticism of their work, but to assist them in arranging the lighting equipment within the framework which they produced so as to make the best use of the wattage installed.

Examples of what might happen due to lack of co-operation between fittings designer and engineer were illustrated by slides of the "before and after" variety. Others showed clearly how an engineer could improve lighting without touching the fittings at all, and how to eliminate shadows and patches. He was also in a position to be able to arrange with the architect to use the best types of wall and ceiling finishes. Spotting was one of the most frequent faults in fittings design. It had been thoroughly investigated and curves had been prepared showing the permissible lamp spacing for varying distances behind the glass. If flashed opal glass were used it should be remembered that, although its absorption might only be 5 per cent., it might transmit less than 50 per cent. of the light from the lamps unless suitable reflecting surfaces were provided. Opal glass would reflect about 45 per cent. from the surface nearest to the lamp.

Adequate Wiring

THE subject debated at the informal meeting of the INSTITUTION OF ELECTRICAL ENGINEERS last week was "Adequate Wiring." Mr. H. G. Taylor opened the discussion by explaining that his concern was mainly for the enormous number of small users of electricity whose installations were limited to a few lighting points, one iron and perhaps a cooker and a wash-boiler. The blame for that state of affairs could not be placed on any particular section of the community, unless it was the electricity supply industry which had not sufficiently educated the public. Builders of houses too often provided services of which the inadequacy was such that it adversely affected the sale of domestic appliances. Owners and architects were frequently uninformed and more concerned with keeping costs low, and there was room for a very big effort to educate the public to the advantages of adequate installations.

In America, he said, the problem was being tackled by a nation-wide campaign, the object of which was to ensure that new houses at least had correct sizes of conductors and an adequate number of outlets. The programme was sponsored by all the principal electrical associations and funds were provided by the National Electrical Manufacturers' Association. Local bureaux were set up and local electrical interests invited to co-operate. The campaign was launched simultaneously with those of the "Better Light—Better Sight" and the "Modern Kitchen." It had been in progress about a year and it was meeting with considerable success.

The author exhibited a number of slides comparing outputs and costs, and his estimate of the value of the business still to be acquired in this country by the supply authorities, cable makers, wiring contractors, &c., ran into millions of pounds. By means of a projector installed by Sound Services, Ltd., he was also able to show a talkie-film entitled "Power for Living," a salesman's "high pressure" house-wiring talk.

Mrs. H. Bentham said that the Electrical Association for Women had anticipated a good deal of the programme Mr. Taylor advocated, and it was eager to co-operate further.

Tir John Power Station

ADDRESSING the West Wales (Swansea) Sub-centre of the INSTITUTION OF ELECTRICAL ENGINEERS on January 28th, Mr. J. W. Burr, the Swansea borough electrical engineer, who is shortly retiring, commented on the alterations at the Tir John power station. The principal part of the plant against which criticism had been levelled, he said, was the gas-washing plant, and it was now proposed to remove this and substitute electrostatic plant. That was certainly common practice all over the country but they must remember that the plant they had was the first of its kind, and although it had many faults, it did its job. It did remove the whole of the grit and the whole of the sulphur from the boiler-house gas. The electrostatic plant could not do that and there must be emission of sulphur and grit from the chimney. It was proposed in order to distribute this over a wide area to put up three 150-ft. chimneys. What the result would be remained to be seen. The history of Tir John had yet to be told and he was quite prepared to be judged by the results.

Conduit Boxes

UP to the present the only conduit boxes for electrical wiring that have been regarded as British Standard have been those made of malleable iron or pressed steel, as prescribed in B.S. Specification No. 31. Many users, however, have employed with satisfactory results boxes made of grey cast-iron, and such boxes are recognised by the 10th edition of the I.E.E. Regulations, provided they comply with certain dimensions and tests. With a view to remedying this inconsistency a B.S. specification for grey cast-iron conduit boxes has now been published. It recognises three sizes of small circular boxes, and lays down full details of the dimensions, screw threads and mechanical tests. Copies of this new British Standard (No. 820-1938) may be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d., post free.

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

Electricity Public Relations Officers?

A DAILY paper has recently been publishing its readers' grumbles, among which figure several complaints regarding electricity service. Many of these are trivial, *e.g.*, "Why do we have to pay for electricity meters, the butcher does not charge us for his scales?" Nevertheless, does it not appear as bad business on the part of the supply undertakings concerned to have so lightly dismissed such expressions of discontent that the alleged grievances have to be ventilated in the daily Press? It also seems to reveal a potential load in abeyance, as such consumers are apt to curtail or refuse to extend their use of the supply as a means of "getting their own back."

This state of affairs suggests the desirability of supply undertakings taking a little more trouble to maintain good relations with their public, and an excellent means of doing so seems to be through the medium of a public relations officer, appointed solely for the purpose. Salesmen and showroom personnel are usually unable to spare the necessary time, and, indeed, a very different technique altogether from that of "sales" is involved if this load in abeyance is to be gained or regained. Much can be done by tact, patience, explanation and a sound understanding of both sides of the matter in dispute to create mutual good will where rancour exists.

It is apparent that the British Broadcasting Corporation has recently begun to pay a great deal of attention to the fostering of good will between itself and the listening public, and there is little doubt that a department on similar lines in supply undertakings would prove worthy of its existence.

January 26th. GILBAS.

Thermal Overload Protection

Mr. Sherwin's letter in your issue of January 27th supports the view which I have held for some time that the correct place for the overload protection of a motor is in the motor itself, and since this protection is against excessive temperature rise and not necessarily against excessive current, it is best provided by a thermal device.

Thermal overload devices incorporated in the switchgear are rarely a completely successful method of protection. One of the reasons for this is mentioned by Mr. Sherwin. Another is the fact that unless specially designed for use with a specific motor, the thermal unit is unlikely to have an exactly corresponding thermal characteristic and in most cases, due to manufacturers' efforts to obtain quick resetting times, will dissipate temperature rises at a rate considerably faster than that of the motor, thus failing to provide protection against cumulative conditions.

The incorporation of a thermal device in the motor windings would therefore appear to be a common-sense solution, but whether a standardised component can be employed with equal success in any type of motor is a matter for conjecture.

Needless to say, the use of such a thermal cut-out does not eliminate the need for overload devices in the switchgear or starter, which still serve a useful purpose in providing fault protection. R. C. LYONS.

Chorlton-cum-Hardy, *January 30th.*

At a recent meeting of the I.E.E., reported in your issue of January 27th, Mr. A. G. Salisbury expressed doubt as to the reliability of the built-in thermal cut-out as applied to fractional-horse power motors.

I would like to take this opportunity of stating the experience of my company in this connection. During the last two or three years some thousands of motors fitted with the "Thermotron" overload protective device have been placed in service in this country and some hundreds of thousands in other parts of the world. Results have demonstrated the complete reliability of the device and the motor to which it has been fitted. The majority of these motors have been used in applications where frequent heavy overloads occur.

Tests have been carried out on motors fitted with this thermal protection where the motor shaft has been locked and the motor connected to the supply mains for periods up to twelve months. Examination at the end of the test has shown no apparent deterioration of the motor windings or the switch contacts.

The remarks of Mr. N. L. Cavallo in your January 20th issue are justified where automatic protection is provided in cases where the manual reset type would have been better suited to the particular application.

There is no doubt the built-in protective device is coming into general use as soon as it is appreciated how small is the premium for this valuable insurance. L. M. MYNARD,
Sales Manager,
DELCO ELECTRIC MOTORS.

London, S.W.1, *January 30th.*

High-rupturing-capacity Fuses

The letters on this subject in your issues of January 13th and 27th are of particular interest as the question of cartridge fuses is very much to the fore at present. Your correspondent in his letter of the 13th has, I think, unduly stressed the question of relative costs, and, in the interests of both manufacturers and users, this point might be examined.

In a domestic installation costing £50 complete without fittings, the fuse boxes, assuming a good class of semi-enclosed fuse is used, may cost at the outside £3. A replacement of this type with cartridge fuses would not exceed 50 per cent. more, the increase representing 3 per cent. of the total cost, certainly a very small amount taking into consideration the great convenience to the user, as well as the safety to the wiring. Beyond all other considerations, it is out of the power of the user to load up the circuit beyond its rated capacity.

The cost of cartridge replacement as against that of a bit of wire is certainly big, but again fusing will be far less frequent with a cartridge which will only fuse upon overloads (and not, as too often happens, through defects in the fuse itself) and, therefore, replacement costs are practically negligible.

Coming to industrial and power plants, the difference in costs tends to become less, and in large units the cartridge type compares quite favourably with the semi-enclosed, largely due to the smaller sizes which can be used for the same rating. In connection with this point I have before me manufacturers' lists giving £3 and £2 16s. each, respectively, as a list price for 300-A rewirable fuses. I have also lists giving £2 14s. and £2 12s. each as prices of the 300-A cartridges complete. In every case the fuses are for panel mounting.

Referring to Mr. C. S. Lawson's letter of the 27th it is quite true that customers ask for the highest class of cartridge fuse, this being due to the belief that this Class 4, B.S.S. 88/1937 is necessary, so that to-day it is really a fetish—25,000 kVA or nothing. The question of testing, as Mr. Lawson points out, is a difficulty, and has greatly retarded the development of the fuse. The tests available at the National Physical Laboratory on DC up to Class 3 have greatly assisted development, and it is to be hoped that AC tests may also in future be undertaken by the N.P.L. I see that an important cable company advertises AC testing plant as available for fuse manufacturers, and no doubt full advantage will be taken of this. CH. W. COX.

Liverpool 8, *January 30th.*

The I.M.E.A. Council

Basis of Representation

LAST week we reported that a meeting of the Incorporated Municipal Electrical Association was being held to consider proposals for altering the basis of representation of large, medium and small undertakings upon the Council. After the meeting the following statement was issued:—

"An extraordinary general meeting of the I.M.E.A. was held at the Caxton Hall, Westminster, London, on January 26th for the purpose of considering certain proposals to amend the articles of association. The meeting was attended by some 450 delegates. When the proposals of the Council were submitted finally a poll was demanded, with the result that 239 voted for and 123 against the resolution. As, however, the Companies Act, 1929, requires a three-fourths majority and the votes of I.M.E.A. members are not weighted, as in joint stock company voting, the proposed revision of articles was not carried."

It is thought likely that a satisfactory compromise will be arrived at by which the views of all parties will be met.

Trolley-buses and National Safety

Admiral Wilmot Nicholson's Views

SPEAKING at a meeting of the Ratepayers' Council held at Holdsworth Hall, Manchester, on Tuesday, Admiral Wilmot Nicholson discussed the question of whether trolley-buses or oil-engined buses should replace the tramways from the national defence aspect. The issue, he said, was whether coal or oil should be used for transport. Last September all great commercial transport undertakings were given authoritatively to understand that in the event of war their petrol and oil supplies would be strictly rationed in the interests of the fighting services. This would have involved a great curtailment of normal services until substitutes for foreign coal could be obtained. That in itself seemed almost a sufficient reason for ensuring that, wherever possible, power derived from British coal should be used for transport and industrial services in preference to power derived from oil.

There was, however, an even more important point. The safety of the whole nation was immediately affected by the demand on sea transport that was made by sections of the nation. Our means of keeping the country supplied with food and essential raw materials were considerably less than in the late war, when we came within sight of defeat owing to our inability to import enough food for our essential needs. To-day we had considerably less home-grown food than we had then. Population had increased, while the number of British merchant ships had decreased by 2,000, of which half were tramp steamers of 2,000 gross tons and over. Moreover, neutral merchant ships, whose services during the late war we could command through our coal bunker control, now used foreign oil and could not be relied upon to serve us.

In addition, the importation of foreign oil would be essential on an incomparably greater scale than in the late war. To-day every propeller in the Royal Navy and in half the tonnage of our mercantile marine was turned by oil power. The mechanised Army could not operate and the Air Force could not fly a machine if the supply of sea-borne oil failed. At least 15 million tons of oil would be needed annually for the fighting services alone. At present we were importing nearly 12 million tons annually, which required some 470 tankers with a carrying capacity of 3 million tons; in 1913 we imported 1.8 million tons and had 170 tankers with a capacity of over 800,000 tons. We were thus less well equipped to cope with demands than we were in the last war.

If a particular system of transport were immeasurably superior to another in peace time there would be a strong case for employing that system, even though it placed an extra strain upon our fighting forces in time of war, but we were not faced with such a choice. The comfort and safety of the trolley-bus was at least equal to that of the Diesel bus, and while the first cost of the electric system might be somewhat higher, this was open to question in many towns where existing tramways were changed over. Also, a comparison of operation costs in other districts seemed to indicate that the cost per passenger mile was somewhat lower with trolley-buses than it was with oil buses. In conclusion, the speaker referred to the increased employment that would be derived from a transport system that was dependent upon the great natural resource of this country—coal.

Admiral Sir Reginald Hall, who was Director of the Intelligence Division at the Admiralty from 1914 to 1918, was unable to be present as he had intended, but sent a telegram expressing the hope that British coal would win a victory in Manchester. A resolution was carried demanding that the City Council should definitely reject the proposals of the Transport Committee to convert the majority of the tramway routes to oil buses and should maintain an electric system, or cause an independent inquiry to be held.

As we go to press we learn that the Manchester City Council, by 54 votes to 35, has approved the report of the Transport Committee by which motor buses will be substituted for the trams on all except two or three routes that are considered more suitable for trolley-bus operation.

Low-pressure Luminescent Tubes

TRANSFORMATION of ultra-violet radiation into visible light of longer wavelengths through exposure of a luminescent substance to a mercury-vapour discharge can be carried out in such a way that sources of an almost negligible amount of light can be made efficient light producers.

Results obtained in the Philips research laboratory relating to the transformation of light emitted by a low-pressure positive column of mercury-vapour discharge are discussed in the company's "Technical Review." The two types dealt with are "impurity luminophores" and fluorescent glass. An example of the first is zinc silicate, which when activated by manganese and crystallised emits light over a wide range of wavelengths in the presence of the discharge. A typical luminescent glass includes uranium compound.

Ultra-violet radiation from a low-pressure mercury-vapour discharge consists mainly of the resonance line 2537 Angstrom units. For the sake of efficiency, the discharge is made to occur at low current density, which results in a small amount of energy being taken up per cm. of length (and small light flux also) and in low tube brightness. The lamps are therefore in small units, *e.g.*, 25 W.

With suitable combinations of pressure (and temperature), tube diameter and discharge current, about half the electrical energy supplied per cm. length of tube can be transformed into radiations with a wavelength of 2537 Au. In order that all the ultra-violet radiation may be used the luminescent layer on the glass should not be too thin; on the other hand, a thick layer may not adhere to the inner wall or it may cause the phosphorescent substance to absorb its own radiation, resulting in loss of light. A thin layer of luminescent material may, however, be used in combination with fluorescent glass, so that the ultra-violet radiation which is not absorbed by the phosphorescent substance is transformed in the glass into visible radiation.

The quantum efficiency, visible light/ultra-violet light absorbed, may reach 80 to 100 per cent., but the energy efficiency when the wavelength emitted is, for instance, 5550 Au. (at maximum eye sensitivity) would be only 2537/5550=46 per cent. With the phosphorescent substances now used, if 50 per cent. of the electrical energy is transformed into radiation at 2537 Au., the quantum efficiency is unity, the energy efficiency is 50 per cent. and 200 lumens are obtained for each watt radiated in the visible range, then the total efficiency of the transformation becomes 50 lumens per W. At the point of maximum eye sensitivity (5550 Au.), however, the green colour of the light may be objectionable, and the light emission of the phosphorescent substance can be adapted to give the requisite values in combination with the discharge.

Details are given of a method of measuring complete emission curves by comparison between block diagrams for daylight and various substances. In these diagrams the whole region of the visible spectrum is divided into eight wavelengths. A spectrum of the light source to be investigated is thrown on a photocell through diaphragms any one of which passes only the wavelengths of one block. By selecting the height of each diaphragm appropriately, the deviation of a galvanometer due to the current of the photocell may be made proportional to the light flux emitted in each block, whereby sensitivity of the eye and of the spectral sensitivity of the photo-cell are taken into account. By means of a light source with a known energy distribution, *e.g.*, a tungsten lamp, the installation may be calibrated. Some luminescent substances act also as light accumulators (emitting light after irradiation has been interrupted) and thus reduce flicker with AC lamps.

Reducing Peak Load Demands

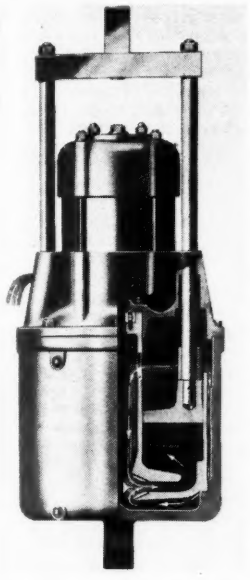
ONE of the reasons put forward by the Heston and Isleworth Corporation in a recent application to the Electricity Commissioners for consent to extend its generating station was to enable the Corporation to deal with peak load conditions of supply. On this the Technical Committee of the London and Home Counties J.E.A. reported last week that in so far as the Corporation's proposals were designed to enable the Corporation to reduce the costs of supplies by a reduction of the peak load taken through the Metropolitan Electric Supply Co. indirectly from the C.E.B., it was not clear from the information received by the Authority that such would, in fact, be the effect. There was a further consideration, *viz.*, that the principle of installing additional plant for the purpose of reducing peak load demands upon the central source of supply was such that its acceptance or rejection was of great importance to practically every authorised undertaking in the country which was in the position of taking a bulk supply directly or indirectly from the C.E.B., and to the Board itself. This principle, it is thought, should be considered with great care and, in the absence of any special circumstances, the consideration should not be prejudiced by an assent or refusal to an extension on these grounds in any particular case.

NEW ELECTRICAL PRODUCTS

A review of equipment recently marketed

Flameproof Servo-motors

TWO sizes of thrustor are being introduced by the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, primarily for operating brakes on underground haulages. One side with a 3-in. stroke exerts a 150-lb. and the other with a 5-in. stroke a 500-lb. thrust. Both are normally designed to work on two-phase or three-phase systems up to 550 V; for haulages operating on higher voltages (up to 3,300) a flameproof transformer can be supplied with a high rupturing capacity switch to provide sufficient low-voltage power to operate the larger model.



A sectional view of the flameproof servo-motor

As the full capacity is available throughout the stroke in a smooth straight-line constant-pressure thrust the thrustor works quickly without mechanical shock, thus preventing strain and excessive wear on the mechanism it operates. It is therefore also suitable for the opening of latches, gates, sliding doors, and transfer mechanism on conveyors by local or remote electrical control and such other operations for which a brake magnet or lever mechanism is employed. Maintenance is minimised due to the absence of packing glands and clutches, and practically all rubbing surfaces are immersed in oil.

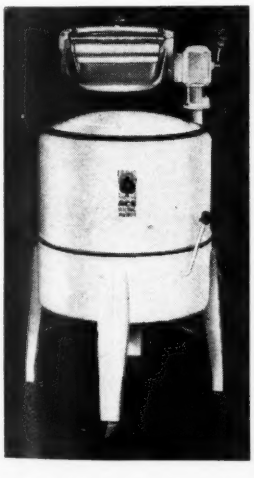
The thrustor consists essentially of an electric motor-driven impeller working in a closed cylinder containing oil, which forces up the piston and transmits the thrust to the operating rods. When the motor is switched off the piston rapidly returns to the "rest" position by gravity.

If the load is greater than the thrustor will lift, the piston remains at the bottom of the cylinder and the impeller spins harmlessly in oil, thus preventing overloading. Similarly, if all load is removed while the thrustor is switched on, the piston stops at the top of its stroke and the impeller again spins in oil.

Buxton flameproof certificates have been issued for both types.

Washing Machines

Two new washing machines have been brought out by the ACE ELECTRIC CO., Queen Street, Huddersfield. The standard model has a gyratory action, controlled by a handle at the side of the machine. Porcelain enamel is used both inside and out and arrangements are made for emptying the tub completely. A "Delco-Remy" motor is fitted. The wringer is adjustable to six positions and all bright parts are cadmium plated. Finger guards and a reversible drip tray can be provided.



The "Ace" de-luxe washer

The "de-luxe" model has a new wringer with an automatic roller stop, automatic drain board and safety release.

A Jack for Cable Conduit

A jack designed for pipe pushing and pulling, and which can equally well be used for cable or conduit, has been introduced by the CONSOLIDATED PNEUMATIC TOOL CO., LTD., 232, Dawes Road, London, S.W.6.

This tool is so constructed that it can be pushed and pulled at one setting of the jack. After a trench 8 ft. by 3 ft. has been dug at the point of entry and exit, the jack is placed in the trench and securely blocked with heavy timbers and channel irons. A three-foot section of pipe is screwed to the jack pilot and also coupled to the jack. The pushing operation is then ready to begin.

By working the handle backwards and forwards the pipe is forced steadily through the ground. After each section has been pushed its entire length a new section is added until it emerges into the receiving end. A larger pipe can be laid by connecting it to the smaller pipe or pulling back through the original entry.

The length of the jack is 6 ft., the travel 3 ft. and the weight 395 lb.

Commercial Lighting Fittings

Two "Sunlite" commercial lighting units have been introduced recently by the SUN ELECTRICAL CO., LTD., 118, Charing Cross Road, London, W.C.2, to provide simple office lighting at competitive prices. The characteristic light distribution curve shows a high intensity of light produced at 45 deg. from the vertical, almost equalling that in the vertical plane.

The fitting itself comprises a hot-stamped ceiling plate, Cash's suspension chain, a lampholder and spun metal gallery supporting a two-piece glass unit. The inner glass diffuser, pearl finished and designed to prevent side glare from the lamp, is shouldered to support the outer opal glass reflector. The upper part of the pearl finished glass transmits a certain amount of light to the ceiling, while the use of opal glass as a reflector avoids the dark appearance often found with reflector fittings.

The Sunlite "Minor" commercial fitting

Two sizes of fitting are available, for 60/100 and 150/200 W lamps with reflector diameters of 11 in. and 13¾ in. respectively.

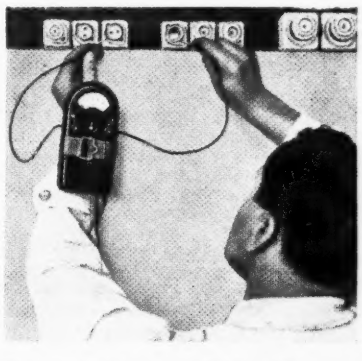
Ceiling Roses and Lampholders

A new range of large-base bakelite ceiling roses and lampholders has been introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. They dispense with the old-fashioned wood block or break ring and can be mounted directly on the ceiling or conduit box. Standard 2-in. fixing centres are provided and the ceiling roses are available with either bakelite or porcelain interiors, with a brown or white terminal cover.

The large-base bakelite backplate lampholders offer similar advantages. The base size is the same, namely, 3½ in., and again either brown or white bakelite covers can be obtained.

Moving-coil Ohmmeter

An unusual pocket instrument for measuring the resistance of the windings of all kinds of electrical apparatus has been introduced into this country by TIME SWITCHES & INSTRUMENTS, LTD., 120, Victoria Street, Westminster, London, S.W.1.



Moving-coil ohmmeter

This instrument is in practice a pocket ohmmeter and when in use is strapped to the back of the left hand, leaving the two hands free to operate the contacts. Various models are available with ranges of from 0-10 ohms up to 0-200,000 ohms, and the dimensions are 2⅞ in. by 5¾ in. by 1¼ in.

Phase Sequence Indicator

Another new development by the same concern is the type FMd phase sequence indicator which shows the direction of rotation of the rotating field to enable wattmeters, phasemeters and current meters to be connected up in the correct manner.

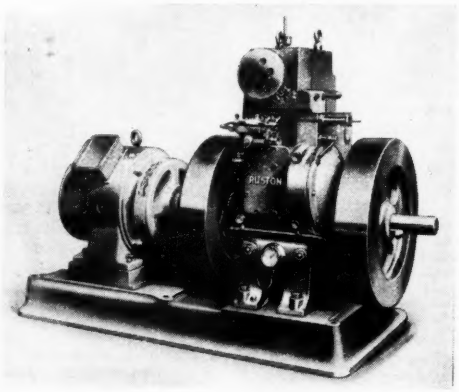
To operate the instrument a rotating field is generated by means of exciting coils connected to the three phases and induces currents in a freely supported aluminium disc, causing it to rotate and indicate the phase sequence.

The instrument can be obtained with a relay for indicating the voltage by means of a small white disc visible through a hole in the instrument case.

E

Diesel Lighting Sets

A new series of Diesel lighting sets has been introduced by RUSTON & HORNSBY, LTD., Lincoln. Rated at from 1.75 kW to 25 kW, they are suitable for either direct lighting or battery charging and are built up of a Ruston Diesel-engine introduced about two years ago and a specially designed generator. The whole set is mounted on a cast-iron underbase and is provided with a separate switchboard, and a battery can be supplied where required. Radiator or tank cooling can be employed, the latter giving a slightly higher kW output. The direct lighting sets have compound wound screen protected DC generators. For battery charging shunt wound screen protected generators are used; in both cases the generators are fitted with two end-shield bearings and a shaft extension for a half coupling. Series starting windings are provided to enable the set to be started up from the battery.



A Ruston Diesel lighting set

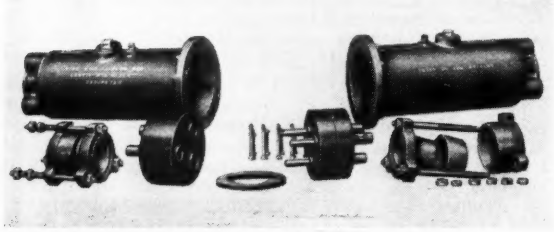
Flameproof Sealing and Coupling Box

To facilitate sealing and jointing and yet provide for easy disconnection and separation the LIVERPOOL ELECTRIC CABLE CO., LTD., Linacre Lane, Bootle, Liverpool, 20, has produced the "Lecupler," a flameproof sealing and coupling box.

As the box can be connected to the cable ends above ground the conductors can be soldered to the connectors and the operation supervised. Where the cables are used in manufactured lengths the makers undertake to connect the sealing and coupling boxes at the works, making provision on the drum to accommodate the sealing and coupling box on the inside end.

The box carcase is a one-piece cylindrical brass casting. The box embodies an original form of internal armour clamp, designed so that while the armour can be made off and secured before the clamp is drawn back into the box, any subsequent tightening up which may be necessary can be achieved by tightening the exterior nuts on the clamp pins. The advantage of the internal armour clamp is that the cable end, including the armour wires, is sealed under compound.

The three-stud fixing of the armour gland gives a strong and mechanically balanced grip on the armouring and the two insulating discs which support the plug sockets and cable connectors are of robust construction and are effectively secured to the box carcase so that the outer disc can be replaced without opening up the box. A further feature of the box is the means for easy removal of the connector pins by an extractor which fits through the small hole in the pin. For use with p.i.l.c. cables a simple device is provided for bonding the lead covering of the cable to the carcase of the box to ensure a good earth continuity.



The "Lecupler" flameproof sealing and coupling box

Two sizes are available, suitable for currents of 100 A and 150 A at 3,300 V.

Ferranti Circulator

FERRANTI, LTD., Hollinwood, Lancs, have recently produced and placed on the market a new circulator in which an Admiralty type element is used. This should appeal to those who regard low cost and ease of replacement as of paramount importance. The terminal compartment is easily accessible, the terminals being of generous dimensions and the special withdrawing device simplifies replacement. It is available in a range of lengths and loadings. It can also be supplied suitable for one-, two- or three-heat control.

The head of the Ferranti circulator

Remote Control of Street Lighting

Particulars of the "Telecontrol" system, which is, we believe, new to Great Britain, have been sent us by A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, London, S.W.1. Its purpose is to provide up to twenty-one signals to enable, for example, street lamps to be controlled either as a whole or in groups or to switch off water-heaters on peak load. The time taken for a complete signal transmission is from 10 to 60 sec. Switching is carried out by means of a voltage drop in the low-voltage supply caused by a break, lasting from 0.04 to 0.08 sec., in one phase of the high-voltage system. This voltage drop is said to be slight as the magnetic interlinkage of the transformer windings prevents more than a transient distortion of the voltage triangle.

The transmitter is connected directly to the mains and the pressing of a push-button automatically produces the correct sequence of impulses which travel over intermediate relays to open a single-pole circuit-breaker rated at 10 kV 400 A; the circuit is reclosed by spring action.

The receiving relay comprises an AC magnet and a small synchronous motor carrying projections that are set to coincide with the sequence of impulses. When the time spacing of three momentary voltage drops is in exact relation to the spacing of the projections, a spring-controlled switch-pin is released to strike a projection and operate a contact.

Lifting Hot Ingots

Magnets for lifting hot ingots up to five tons in weight are now made by the Witton-Kramer Tool and Hoist Works of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.

Two bi-polar units recently constructed are used for handling steel ingots and billets at temperatures up to 700 deg. C.

The coils with their cover are protected by a special heat-diverting shield between the magnet poles. Aluminium coils, which are not affected by high temperature, are employed in place of copper coils with tape or micanite insulation between the turns. The leads are taken through steel tubes projecting above the terminal boxes, thus keeping the cable as far as possible from the heat rising from the ingots and, furthermore, the whole magnet is designed in such a way that it can be immersed safely in water to cool the pole pieces when they have been in contact with the hot ingots for a long time.

In other respects these electro-magnets follow the standard Witton-Kramer design. The poles are of cast-steel, and a substantial shell of non-magnetic material protects the coils. Each magnet weighs 27 cwt. complete. When energised at 220 V, DC, the flushing consumption is 3¼ kW, which is reduced to 2¼ kW by means of a continuously rated series economy resistance, inserted automatically by the contactor control gear.

The Witton-Kramer magnet for lifting hot ingots

The poles may be specially designed to suit the percentage of manganese in the steel to be lifted, or to operate with a line contact on convex or fluted ingots.

Purifying and Drying Transformer Oils

In our January 13th issue we illustrated a purifier and filter for transformer oil; the descriptive matter referred only to the filter press which removes sediment and moisture. The deterious action of small quantities of acid present in the oil have led G. LISTER, GLOUCESTER (1937), LTD., Dursley, to develop the purifier in addition and the combined unit was illustrated.

In the combined unit the oil passes through a filter bed, a second filter of minute straining material and finally through a paper filter to remove moisture. Circulation is by means of an electrically driven pump designed to eliminate turbulence. It is stated that switch oils containing carbon can be completely purified. Both inlet and outlet strainers are provided.

NEW BOOKS

Gaseous Conductors, Putting Plant into Service, Plan for Industry

Gaseous Electrical Conductors. By E. L. E. Wheatcroft. (Pp. 265; figs. 140.) Oxford University Press. Price 21s.

THIS is an excellent addition to the Oxford Engineering Science Series, and should appeal to the serious engineer whose problems are associated with its subject.

The earlier part deals with some of the familiar conceptions of the structure of matter, the nature of a gas and its properties in relation to the conducting state. A summary of ionisation processes paves the way for descriptions of the functioning of various types of apparatus which follow. A chapter on "The Electronic Nature of a Metal" is particularly interesting, and summarises the results of work on thermionic, photo-electric, and secondary emission from metallic surfaces. It is followed by discussions on the motion of ions and electrons, which, because of their mathematical nature, will appeal chiefly to the more advanced worker.

Succeeding chapters deal successively with the insulating state, the glow discharge, and the arc, and describe the development of high conductance in gases which can oscillate rapidly between states of good insulation and good conduction. Part I concludes with theories of sparking mechanism and the phenomenon of time lag.

In the second part of the book the author describes the application of the principles so far discussed to a number of typical electronic devices. Successively he deals with vacuum electron valves, gas-filled valves, mercury-arc rectifiers, circuit-breakers, and luminous discharge tubes. In each of these sections the underlying theory is followed by a description of typical equipment and much useful data on performance characteristics.

The index might have been increased with advantage, particularly as the book will undoubtedly find its way into the libraries of works and university laboratories and be used by research workers. A bibliography is to be found at the end of each chapter, and numerous references to original papers occur in the text. J. N. A.

Practical Mechanic's Handbook. By F. J. CAMM. (Pp. 400; figs. 379.) London: George Newnes, Ltd. Price 6s.

The mechanic, whatever the branch of technical work he is engaged in, will find this handbook by the editor of "Practical Mechanics" a most useful publication. In its compilation such matter as is common property and easily come by is passed over in favour of the specialised information which it is much more difficult to find.

The book is divided into four approximately equal parts. Representative of the contents are a five-page article on "Marking out for Machining," in which the methods applicable to small work are clearly set out with the aid of a set of photographs, a section on "Case Hardening" in which means are suggested which should be available anywhere, and another on "Battery Charging," which runs to twelve pages of well documented and illustrated matter.

Throughout the book numerical data are tabulated as far as possible, thus being readily separable from descriptive and explanatory information. This book should make a strong appeal to those for whom it has been prepared.—J. A. C.

The Commissioning of Electrical Plant and Associated Problems. By R. C. H. RICHARDSON. (Pp. 363; figs. 201.) London: Chapman & Hall, Ltd. Price 21s. net.

We can recall no other book which covers just the same ground as does this one, so that we may start with the feeling that at the least the subject warrants its own special literature. True, it has been dealt with in a sporadic sort of way from time to time in papers and articles in institution journals and the technical Press, but coherent book form is essential for maximum usefulness.

The present work embraces rotating and static plant—alternators, AC and DC motors, convertors, transformers and rectifiers—and while much of what it contains is perhaps common knowledge to the expert, it is a most useful co-ordination of good practice and precept on a subject which has by no means been overwritten. Whilst a certain proportion of the matter in the book is a question of opinion—and experience—mostly the contents are statements of undisputable cold facts so that the work is likely to maintain its practical value for a long time and that is of no little advantage.

In each of the five principal sections the author first deals with the preliminary adjustments and precautions necessary before placing the plant into service and then proceeds to a study of the initial operating conditions and the special tests required to ensure ultimate satisfactory performance. The troubles and difficulties likely to be encountered are described and it is shown how these may be anticipated or eliminated. The section, in each case, is concluded by a presentation of theoretical and practical considerations bearing upon the operation and commissioning of the plant in question. The parallel operation of both rotating machines and static plant receives particular attention in view of the progress which has been made in the linking-up of stations and networks.

The last section, on some technical methods used in electrical engineering work, deals very briefly with vector operators, symmetrical components, the reduction of networks, short-circuit calculations, definitions of p.f. and kVA, and watt-meter type relay connections and a useful bibliography of books and papers enables the reader to pursue a study of the various subjects in greater detail.

The book is a very happy combination of the more elementary theories of electrical plant and sound practical experience in the setting to work thereof and it should prove a welcome guide to erection engineers, particularly those who have yet to reach that degree of sophistication commonly found in their older brethren of the craft.—S. A. S.

Plan and Serve. By A. P. Young, O.B.E. (Pp. 140.) London: Management Publications Trust. Price 3s. 6d. net.

Mr. A. P. Young, the manager of the B.T.H. Rugby works, is well known for his enlightened pronouncements on industrial matters. In this work, proceeding from the view that social adjustment has not kept pace with industrial development, he sets out to evolve a new industrial order in which the profit motive would be superseded by "planning for service."

It is shown that *laissez-faire* methods have been abandoned in some of the leading countries and in some of the leading industries in Great Britain. Mr. Young visualises the setting-up of twelve planning control boards to control our basic industries, representative of labour, management, capital, and consumer. The chairmen of these boards, together with the heads of certain Government Departments and specially selected members would form an "industrial cabinet" at the head of an "industrial parliament" composed of all the members of the twelve boards. The chairman of the "cabinet" would be a "Minister of Industry" and act as a link between industry and the political organisation.

For the electrical industry there would ultimately be two boards, one controlling generation, distribution, and (presumably) installation, and the other the whole manufacturing industry.

Throughout the book the ethical aspect is stressed and the practical application of Christian principles is held to be possible, but too little regard is paid to our all-important overseas trade, which makes planning dependent upon international agreement. In a foreword Sir Felix Pole says that the difficulties with which Mr. Young has had to grapple have not damped his idealism, nor are his proposals lacking in boldness. Many readers will think with Sir Felix that some are too bold or widesweeping, but all will agree with him that the book will stimulate thought, and that, in these days, is an essential service.—J. H. C.

Problems in Public Utility Economics and Management (Second Edition). By C. O. RUGGLES. (Pp. 759). London: McGraw-Hill Publishing Co., Ltd. Price 36s.

The author of this work occupies the chair of "Public Utility Management" in the Graduate School of Business Administration at Harvard University. The method of the book is to pose specific examples of questions which have arisen in American utility practice, the solutions arrived at, with Court decisions in the cases dealt with juridically, and at the end of each "case" puts some questions covering essential issues for the student to answer. The author's answers are not given.

There are 120 problems classified under the seven heads:—I. Economic Characteristics of Public Utilities; II. Production Problems of Public Utilities; III. Management, Organisation, and Finance; IV. Wholesale Marketing of Public Utility Service (*i.e.*, bulk supply practice, rates, &c., mixed service such as electric and steam); V. Retail Marketing of Public Utility Service (bases of rates, cost versus value of service, "promotional" rates; preferential rates, &c.); VI. Valuation, Rate-making, and Fair Return (the cases include some in which decisions of State Regulating Commissions have been challenged as "confiscatory"); VII. Regulation and Management (cases involving the distinction between regulation and interference with legitimate functions of the management).

The first section deals with the question of what distinguishes undertakings from the private venture class so that statutory regulation (of prices, methods of business, &c.), becomes justifiable. In the United States this is a legal question, because under the Constitution governmental interference with private business activities is forbidden. When a business is of such a nature in the circumstances considered as to be "affected with a public interest" regulation of its conduct in so far as necessary for the protection of that interest is held to be justifiable, and is not an invasion of the proprietor's constitutional rights.

A conclusive decision that an Act of a State Legislature or of Congress which imposes Governmental regulation or control upon specified undertakings is constitutional and valid or otherwise can only be given by the U.S. Supreme Court.

The first section states three cases in which the Supreme Court upheld regulatory laws passed by State Legislatures, and three in which the Court denied the powers of regulation assumed by the laws challenged. A comparison of the judgments in these six cases is instructive as showing that because the Supreme Court has upheld regulatory laws applied to a

certain kind of business in one State, it does not follow that it will uphold identical measures in another State; it seems to have much less regard for its own precedents than have the British Courts.

Some of the problems in other sections involve the application of regulatory laws, *e.g.*, whether a rate-making decision of a Public Service Commission amounts to "confiscation" of the property of the undertaking. Many of the cases involve questions of policy and management not resulting in litigation.

The problems are presented clearly, well documented, and with emphasis on the essential issues. The reviewer recommends the book to all interested as a novel and useful objective treatment of the subjects discussed.

Shorter Notices

"Manual of Electrical Undertakings" (Garcke). (Pp. 1,879.) London: Electrical Press, Ltd. Price 37s. 6d.—This is the forty-first edition of what is probably the most useful electrical directory. As usual, it contains a mass of statistics relating to electricity supply undertakings in this country and in the Dominions and Colonies, as well as manufacturing companies, contractors and directors and officials. Altogether three thousand electrical undertakings are dealt with. All sections have been thoroughly revised and brought up to date and the detailed accounts and statistics refer for the most part to the financial year 1937/8.

"Aluminium Bronze." (Pp. 151; figs. 83.) London: Copper Development Association. This is an addition to the already comprehensive list of the Association's publications. It is divided into sections covering general properties, cold and hot working bronzes, aluminium bronze for casting, corrosion resistance, production and fabrication. A diagram of electrical properties is included and there is an article dealing with electrical and thermal conductivity.

"The Elements of Radio Communication," by O. F. Brown and E. L. Gardiner. 2nd ed. (Pp. 551; figs. 171.) London: Oxford University Press. Price 16s.

"Handbook of Technical Instruction for Wireless Telegraphists," by H. M. Dowsett. 6th ed. (Pp. 624; figs. 578.) London: Iliffe & Sons, Ltd. Price 21s.

"Trade Marks," by R. Haddan. (Pp. 128.) Price 5s.
"Electric Lifts," by R. S. Phillips. (Pp. 293; figs. 191.) Price 20s. London: Sir Isaac Pitman & Sons.

"A Short History of Science," by F. Sherwood Taylor. (Pp. 320.) London: W. Heinemann. Price 8s. 6d.

Argentine Electrical Imports

Large increase in 1937

THE accompanying statement, based on the recently issued Argentine official foreign trade returns, shows the values of the country's chief electrical imports during 1937, together with the principal suppliers. For purposes of comparison notes of increases or decreases have been added. The trade as a whole rose in value by nearly 30 per cent. compared with 1936, and it will be seen that every group shared in the rise. The advance in the cable and wire (excepting flex) business was striking, but Britain had a poor share in the progressive radio trade. Diversity of competition continues noteworthy, for all the important electrical manufacturing countries of Europe have participated, with Canada and Japan also making appearances.

When the figures for 1938 are available it is hardly to be expected that the electrical import trade will show the same rate of progress as it did in 1937. The economic position of the country has been affected by the poor grain crop and the decline in world prices. The values, which are in paper pesos at 17 to the £, are in accordance with the official valuations of the Argentine Customs Department.

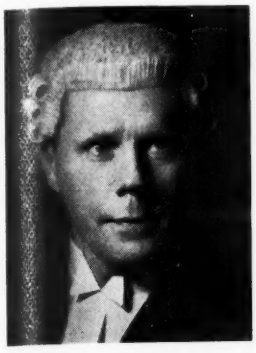
	1937. Pesos (000)	Inc. or dec. on 1936. Pesos (000)
Fan motors—		
Total	357	+ 136
From Germany	54	− 3
„ Japan	62	+ 44
„ United States	126	+ 14
„ Italy	83	+ 60
„ United Kingdom	32	+ 21
Motors, up to ¼ HP —		
Total	330	+ 155
From Germany	24	+ 14
„ United States	232	+ 104
„ Italy	6	+ 4
„ United Kingdom	62	+ 34
Motors and dynamos, over ¼ HP —		
Total	3,190	+ 379
From Germany	1,195	+ 234
„ United States	374	− 77
„ Denmark	146	+ 77
„ Italy	177	+ 50
„ Holland	106	− 7
„ United Kingdom	569	+ 218
„ Sweden	374	− 118
„ Switzerland	112	− 31
Cable and wire, up to 5 mm., covered with cotton, rubber, etc.—		
Total	1,554	− 119
From Germany	310	− 112
„ United States	165	+ 42
„ United Kingdom	750	+ 39
„ Canada	13	− 31
„ Belgium	128	− 90
Cable and wire, over 5 mm., covered with cotton, rubber, etc.—		
Total	548	+ 112
From Germany	127	+ 17
„ United States	57	− 37
„ United Kingdom	278	+ 110
Cable and wire, up to 5 mm., lead-covered—		
Total	284	+ 31
From Germany	58	− 19
„ United Kingdom	163	+ 78
„ Sweden	53	+ 25
Cable and wire, over 5 mm., lead-covered—		
Total	3,027	+ 1,103
From Germany	118	+ 13
„ Belgium	48	+ 40
„ United Kingdom	2,736	− 1,441
Wire, electrical, enamelled—		
Total	405	+ 107
From Germany	91	+ 19
„ United States	182	+ 38
„ United Kingdom	104	+ 34
Cable and wire, silk-covered—		
Total	34	− 11
From Germany	10	− 4
„ United States	4	− 5
„ United Kingdom	9	+ 1
Telephone cable, underground—		
Total	6,949	+ 2,702
From Germany	2,067	+ 27
„ Italy	1,542	+ 1,508
„ Holland	172	− 32
„ United Kingdom	655	+ 192
„ Sweden	441	+ 351
Telephone cables of iron or steel, covered—		
Total	570	+ 163
From United States	561	+ 297
Accessories for underground cables—		
Total	165	+ 90
From Germany	123	+ 66
Insulating tape—		
Total	268	+ 23
From Germany	71	+ 28
„ United States	85	− 3
„ United Kingdom	58	− 2
„ Japan	16	+ 6
Flex—		
Total	625	− 1,523
From Germany	53	− 56
„ Belgium	47	—
„ United States	77	− 340
„ United Kingdom	376	− 1,176
Accumulators and parts—		
Total	1,920	+ 610
From Germany	334	+ 74
„ United States	1,193	+ 495
„ Japan	7	− 13
„ United Kingdom	148	+ 27
„ Canada	93	− 11
„ Belgium	22	− 11
Batteries—		
Total	1,798	+ 165
From Germany	3	− 5
„ United States	1,626	+ 169
„ United Kingdom	70	+ 26
„ Denmark	98	− 22
Ammeters and voltmeters—		
Total	164	+ 54
From Germany	78	+ 31
„ United States	53	+ 28
„ United Kingdom	21	+ 2
Radio-telephone apparatus—		
Total	1,009	+ 166
From Germany	30	− 101
„ United States	555	− 13
„ Holland	340	+ 251
„ United Kingdom	75	+ 29
Receiving valves—		
Total	4,338	+ 1,087
From Germany	19	− 5
„ United States	3,298	+ 769
„ Hungary	207	− 9
„ Holland	796	+ 355
„ United Kingdom	17	− 23
Amplifier valves—		
Total	133	+ 59
From United States	117	+ 51
Loudspeakers (metal)—		
Total	715	+ 345
From United States	642	+ 338
Radio-telephone parts—		
Total	3,414	+ 1,148
From Germany	690	+ 465
„ United States	2,104	+ 504
„ United Kingdom	159	− 12
„ Holland	380	+ 162
Telephones—		
Total	925	+ 327
From Sweden	50	+ 24
„ United Kingdom	13	− 5
„ Germany	100	+ 16
„ Belgium	706	+ 243
Telephone material—		
Total	834	− 7
From Germany	22	+ 3
„ Belgium	252	− 1
From United States	128	+ 8[illegible]
„ United Kingdom	232	− 3[illegible]
„ Canada	140	− 6[illegible]
Electric bells—		
Total	133	+ 6[illegible]
From Germany	43	+ 4
„ Belgium	8	+ 7
„ Italy	75	+ 4[illegible]
„ United Kingdom	3	—
House-service meters—		
Total	3,222	+ 1,01[illegible]
From Germany	1,917	+ 44[illegible]
„ Denmark	90	+ 5[illegible]
„ United States	57	+ 1[illegible]
„ United Kingdom	42	+ 1[illegible]
„ Switzerland	530	+ 24[illegible]
„ Sweden	311	+ 20[illegible]
Electric incandescent lamps—		
Total	1,923	+ 20[illegible]
From Germany	105	+ 4
„ Belgium	235	+ 8[illegible]
„ United States	141	+ 1[illegible]
„ Japan	880	+ 8[illegible]
„ Holland	117	− 6
„ United Kingdom	168	+ 1
Switches, circuit-breakers, cut-outs, fuses, etc.—		
Total	1,506	+ 33[illegible]
From Germany	906	+ 17[illegible]
„ United States	214	+ 6[illegible]
„ United Kingdom	120	− 4
„ Italy	105	+ 7[illegible]
„ Belgium	98	+ 2
Distribution boards—		
Total	210	− 17[illegible]
From Germany	49	+ 4
„ United States	1	− 31[illegible]
„ United Kingdom	93	+ 8[illegible]
Change-over switches—		
Total	797	− 14[illegible]
From United States	617	− 26[illegible]
Heaters, toasters, kettles, etc.—		
Total	211	+ 45
From Germany	150	+ 37
„ United States	38	+ 12
Vacuum cleaners—		
Total	228	+ 19
From Germany	31	− 16
„ United States	25	+ 5
„ Sweden	158	+ 20
Electric irons—		
Total	386	+ 161
From Germany	211	+ 114
„ United States	142	+ 39
Insulating tubes—		
Total	1,553	+ 58[illegible]
From Germany	1,158	+ 40[illegible]
„ United States	104	+ 2[illegible]
„ United Kingdom	222	+ 9[illegible]
Electrical materials, unspecified—		
Total	3,264	+ 454
From Germany	1,304	+ 351
„ United States	911	− 146
„ France	45	+ 5
„ Italy	43	+ 2[illegible]
„ United Kingdom	280	+ 5[illegible]
„ Sweden	36	+ 2[illegible]
„ Switzerland	128	+ 13

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

LAST week **Mr. P. Hamilton,** managing director of Everett, Edgcumbe & Co., Ltd., left with his wife and daughter for Capetown. He will visit Bulawayo, Victoria Falls, Pretoria, Johannesburg and the Kruger National Park, returning from Durban in the *Dunvegan Castle* and calling at the various ports on the east coast and the Suez Canal. He will be returning to this country about the middle of April.

Mr. R. Birt, B.Sc., M.I.E.E., A.M.Inst.C.E., A.M.I.Mech.E., borough electrical engineer and manager to the Ealing Corporation, has added to his distinctions by being called to the Bar. He went to Ealing in 1926 and succeeded Mr. J. D. Knight (who is now a member of the Town Council) as electrical engineer and manager when he retired in 1934. Mr. Birt received his technical education at Battersea Polytechnic and his practical training with the B.T.H. Co. at Rugby. Later he joined the commercial staff of the Ayrshire Electricity Board. While he has been at Ealing the station has changed over from generating to taking a bulk supply.



[*Howard Coster*
Mr. R. Birt

Mr. W. Davies, A.I.E.E., engineer and manager of the Tredegar U.D.C. Electricity Department, has been awarded a special prize by the South Wales Institute of Engineers for an essay on "Mines Lighting." Mr. Davies received first prize in a similar competition on the same subject in 1932 at the Royal National Eisteddfod, Wales, and has also lectured on the subject to the South Wales Branch of the Association of Mining Electrical Engineers.

Manchester has always been noted for enjoying good music, and it is interesting to record that its Electro-Harmonic Society, which is now in its twentieth season, is still flourishing, judging by its successful annual ladies' evening held at the Manchester Limited Restaurant on January 28th. Nearly 300 members and friends representing all sides of the electrical industry sat down to an excellent dinner, and each lady received a present. **Mr. A. B. Race,** president of the society, who was accompanied by Mrs. Race, in proposing the toast of the ladies, mentioned that the ideal or bond that held the members together was a common interest in "middlebrow" music. Messrs. J. D. Nettleton and H. W. Hansen, the M.C.'s, had things going merrily immediately after dinner, and the floor was soon thronged with dancing couples. The hon. secretary, Mr. C. E. Leak, and the organising committee, are to be congratulated upon planning a very successful evening.

Mr. H. Lucas, G.P.O. Box 2046L, Sydney, Australia, has been appointed factory representative for the lighting products of Benjamin Electric, Ltd., in the Commonwealth of Australia.

Mr. E. A. Guthrie, A.M.I.E.E., of the Metropolitan-Vickers Electrical Export Co., Ltd., has now returned to the company's head office, 1, Kingsway, London, W.C.2, after a seven months' business tour in South Africa.

The well-known hexagon trade mark of the Metropolitan-Vickers Electrical Co., Ltd., has undergone a temporary change. It has caught the pantomime spirit and has become a geometrical "cat" in order to follow the varying fortunes of "Dick Whittington" for a week at the Palace Theatre, Manchester. This angular "cat" adorns the cover of a souvenir book issued to each of the Met.-Vick employees and their relatives attending the theatre on the evenings of January 30th to February 3rd. For each of these six performances the entire theatre has been booked by the Met.-Vick Co. On Friday (January 27th) the principals of the pantomime cast were entertained to lunch at the Trafford Park works. They were received by Mr. G. E. Bailey, the works director, and conducted on a short tour of the works by Mr. J. S. Peck and Mr. K. Baumann, directors.

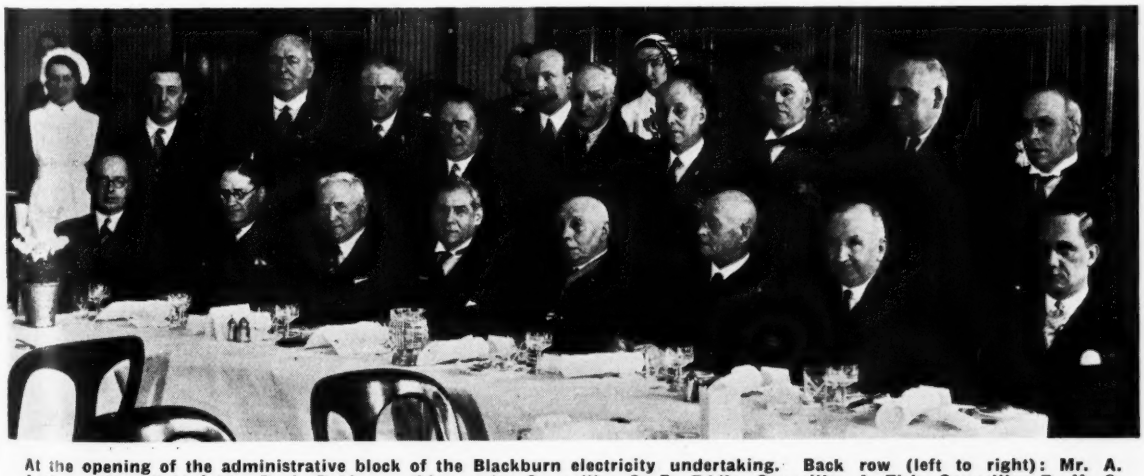
Sir R. W. Brooke has been appointed a director of the Scottish Power Co. in succession to the late Sir Thomas Callender.

Mr. F. J. Bettley, transport manager and registrar of W. T. Henley's Telegraph Works Co., Ltd., retired on January 31st after nearly forty-two years' service with the company. He joined Henley's as a junior when the head office staff numbered about twenty. His work was mainly concerned with the cable stocks at branches and agencies and with the share work of the company. Eventually he took over duties in connection with shipping, which later developed into the transport department. During his long service he was always closely identified with the social activities of the staff. In November, 1937, Henley's directors, together with Mr. Bettley's friends in the company, presented him with a Chippendale period XVIIIth century mahogany bureau writing desk and a gold cigarette case as a token of their esteem. On Tuesday last the head office staff assembled to wish him farewell, and Mr. W. F. Bishop presented him with a Westminster chiming clock, subscribed for by his associates, and yesterday (Thursday) he was the guest of honour at a supper arranged by his Henley friends and presided over by Mr. Bishop. **Mr. H. Murfin** has been appointed transport manager and **Mr. A. E. Aller** registrar.

Mr. F. J. Bettley

Mr. A. P. Laughland, A.I.E.E., of "Hamstead," Northfield, Birmingham, has joined the sales organisation for industrial, marine and transport diesel and petrol engines throughout England, Scotland and Wales of W. H. Dorman & Co., Ltd. During the past eighteen years, Mr. Laughland has been associated with Vickers Petters, Ltd., of Ipswich, and Petters, Ltd., of Yeovil. He was trained at the B.T.H. Co., Ltd., Rugby, and during the war served under Col. Sir James S. Pitkeathly, D.S.O. as D.A.D.W. (Electrical and Mechanical Section) R.E., for which services he was mentioned in dispatches.

The annual smoking concert of the English Electric (Stafford Works) Engineering Society took place on January 25th and although the district was deep in snow there was an attendance of over 200 members, and it proved to be a most enjoyable function. The chair was taken by **Mr. J. Rogers,** general manager of works, and he was supported by a number of officials of the company. A telegram was received from Mr.



At the opening of the administrative block of the Blackburn electricity undertaking. Back row (left to right): Mr. A. Latham (Mansfield); Mr. P. J. Robinson (Liverpool); Councillor G. B. Eddie, Councillor J. Fish, Councillor R. H. G. Horne, Councillor A. Townsend, Ald. J. Atkinson, Councillor B. S. White, Councillor J. W. Baker, Councillor W. Hare. Seated (left to right): Mr. W. A. Royle (Sunderland), Mr. R. H. Harral (engineer and manager, Blackburn), Ald. C. A. Critchley, Sir Cyril Hurcomb (chairman, Electricity Commission), Ald. F. J. Greeves, Ald. W. Walker (Manchester), Councillor E. Porter, Mr. C. S. Robinson **(see page 174)**

G. H. Nelson, the chairman and managing director of the company, wishing the society continued success. Mr. C. Hollander, commercial manager, proposed the toast of the "Engineering Society" which was responded to by Mr. F. Wallis, assistant chief engineer. At the conclusion of the programme a vote of thanks to the chairman was proposed by Mr. A. D. Sloan, chief engineer.

There was a large attendance at the annual staff dinner and dance of the Telegraph Construction and Maintenance Co., Ltd., and Submarine Cables, Ltd., held last Friday at the Trocadero Restaurant, London, W.1. Mr. R. A. C. Johnson, director of Richard Johnson & Nephew, Ltd., proposed the toast of the two companies and in responding **Sir Geoffrey Rothe Clarke,** C.S.I., O.B.E., mentioned that a letter of thanks had been received from the French Government for the expeditious way in which a cable had been laid by the *Faraday*. The toast of "The Ladies and the Visitors" was proposed by Mr. Colin F. Campbell, who congratulated Sir Geoffrey on his recent appointment by the Prime Minister. The reply was given by Mrs. Smith, in place of Lady Clarke, who was indisposed, and Mr. F. Selley. The health of the chairman, Mr. L. J. Ransom, was proposed by Lord Riverdale.

Mr. C. Surman has been appointed depot manager at Cambridge to Flinders (Wholesale), Ltd., in succession to the late Mr. A. E. Dant, and **Mr. W. Wilby,** who has been the company's Suffolk representative for some years, has been transferred to Cambridge where he will take up his duties as outside representative and sales engineer.

A successful dance was held by the Western Electric Co., Ltd., at Cricklewood, on January 21st, in aid of the Greater London Fund for the Blind. Mr. F. W. Wort performed the duties of M.C.

Mr. Thomas Hutchinson, of the electrical staff of the Balgonie Colliery Co., Markinch, has been appointed electrical engineer at Springfield Colliery, Redan, South Africa.

Mr. W. K. Fox has been appointed secretary of Sterling Electric Holdings, Ltd., in place of **Mr. G. S. Rate,** who has resigned.

A joint meeting of the Brighton Corporation Tramways and Special Transport Committees has recommended the appointment of **Mr. W. Robinson,** A.M.Inst.T., as general manager and engineer of the Corporation tramways and transport undertakings.

Mr. W. H. Ellerker, of Monkseaton, has been appointed showrooms superintendent to the West Hartlepool Corporation Electricity Department.

About 160 members and their friends were present at the annual dinner of the Stoke-on-Trent Branch of the Electrical Association for Women presided over by **Mrs. H. Lesse** (president of the branch) at Hanley on January 12th. A message was sent to Mr. C. H. Yeaman, the city electrical engineer, wishing him a speedy recovery from his illness.

Mr. G. Wolfe, export director of S. Wolf & Co., Ltd., left England on January 26th on a trip to South Africa to visit the company's distributors and agents in that country who are handling the sales of "Wolf" electric tools. Mr. Wolfe will visit all centres of importance with a view to giving assistance to agents where this is necessary and will at the same time make personal contact with the leaders of industry in South Africa.

The ex-servicemen of Callender's Cable & Construction Co., Ltd., held their annual reunion dinner at Hartridge's, London, on January 27th. About sixty members were present and in the absence of their president, Mr. T. O. Callender, **Mr. F. W. Augood** took the chair and was supported by Mr. D. G. Donoon, Mr. F. W. Hills and Mr. Walter Eagles. Representatives from Belvedere and Anchor Works also attended.

Arising out of the retirement from London Transport on January 31st of **Mr. C. S. Louch,** the comptroller and accountant, the Department will be divided between the department of the chief accountant and the department of the chief financial officer. **Mr. L. C. Hawkins** will become chief accountant, and **Mr. F. A. A. Menzler** chief financial officer.

OBITUARY

Mr. W. J. Chalmers.—The *Electrical World* reports the death of Mr. William J. Chalmers, retired chairman of the Allis-Chalmers Co., of Milwaukee, which occurred on December 11th at Chicago in his eighty-seventh year. From boyhood to his retirement Mr. Chalmers was engaged in the manufacturing of mining machinery. Under his direction Allis-Chalmers grew to be one of the largest makers of mining machinery in the world. In 1872 Mr. Chalmers helped to form the original co-partnership of Fraser, Chalmers & Co. In 1891 the company consolidated with the E. P. Allis Co. as Allis-Chalmers, and Mr. Chalmers served this company as head, retiring in 1906.

Prof. G. B. v.d. Werfhorst.—We regret to record the death of Prof. G. B. v.d. Werfhorst, one of the leading authorities on lighting in the Philips organisation and a Professor at the University of Utrecht.

Mr. John Lomas, former electrical engineer to Mirfield (Yorkshire) Urban District Council, died on January 26th at the age of seventy-six at his home in Mirfield. He held positions at Huddersfield and Bradford before taking charge of the electrical plant at the Royal Princes Parade, Bridlington. It was from there, in May, 1905, that he accepted the electrical engineer's position at Mirfield when that authority began its electricity supply. Mirfield, under Mr. Lomas's direction, was the first local authority to take a bulk supply from the Yorkshire Electric Power Co. He retired six years ago.

Mr. R. S. Middleton.—The death occurred in a nursing home in Newcastle on January 28th, at the age of seventy, of Mr. Richard Stephenson Middleton, deputy chairman of Richardsons, Westgarth & Co.

Will.—Mr. Joseph Orringe, senior partner in the electrical engineering firm of Gent, Hurley & Orringe, of Leicester, left £28,976, with net personalty £20,847.

Mr. John Ferguson, vice-chairman of British Insulated Cables, Ltd., left £63,816.

In the Courts

Sequel to Electrician's Injuries

IN the Court of Appeal, before Lords Justices Slesser, Clauson and Du Parcq, on January 27th, the hearing was concluded of the case of Bigny *v.* the Corporation of the City of London (F. H. Wheeler & Co., Ltd., third parties) on the appeal of the third parties from the judgment of Mr. Justice Hawke in the King's Bench Division, holding that they were liable to indemnify the City Corporation for the damages of £1,500 it had agreed to pay the plaintiff, Mr. Alfred H. Bigny, an electrician, for personal injuries he sustained in September, 1936, while working for Messrs. Wheeler & Co., electrical contractors, of 39, Victoria Street, London, S.W., at the Central Criminal Court and £105 agreed costs. The proceedings were reported in the ELECTRICAL REVIEW of March 11th and April 29th, 1938.

The facts were that in September, 1936, Mr. Bigny fell 72 ft. from near the ventilating shaft in the Court and sustained very serious injuries. At that time his employers, Messrs. Wheeler & Co., had taken over the electrical installation work in the Court from the original contractors, who had failed to complete it within the specified or contract time, but no formal contract under seal had been entered into between the Corporation and Messrs. Wheeler & Co. In those circumstances Messrs. Wheeler & Co., while admitting that most of the conditions of the original contract could be implied into the new or *interim* contract, claimed that the one as to indemnification could not. They further contended that the Corporation should not have compromised the claim with Mr. Bigny and they further pleaded that the latter had been guilty of contributory negligence by going to the place from which he fell against the warning not to do so. Mr. Justice Hawke held that Messrs. Wheeler & Co. were in the circumstances bound by the terms and conditions contained in the contract entered into by the City Corporation and the original electrical contractors and that they were under a liability to indemnify the Corporation against the damages and costs which the Corporation had paid to Mr. Bigny and his Lordship granted a declaration to that effect, stating that he thought the settlement arrived at between the Corporation and Mr. Bigny a reasonable one in the circumstances. From this result Messrs. Wheeler & Co. now appealed.

At the conclusion of the arguments of counsel the Lords Justices allowed the appeal, set aside the order of Mr. Justice Hawke and sent the case to a Referee, the costs of the appeal to be the appellants' and the costs of the inquiry before the Referee to be left to him.

On behalf of the Corporation leave to appeal to the House of Lords was granted.

Railway Signal Patent Action

On Wednesday last Mr. Justice Morton delivered judgment in favour of the Westinghouse Brake & Signal Co., Ltd., in the action brought against them by the General Railway Signal Co., Ltd., for alleged infringement of the letters patent for a system of railway signalling which has been before the Chancery Division for several weeks.

Winding-up Orders

In the County Court on January 30th, Mr. Justice Simonds had before him a petition for the compulsory winding-up of Ismay's Refrigerating Co., Ltd.

This was a petition by Briton Lamps, Ltd., of Ilford, Essex, judgment creditors for £396, and also a petition by Ismay Industries, Ltd., a holding company, for £27,000 odd, and who were also creditors on a contingent liability for £43,000, having guaranteed the company's banking account. There was also a supporting creditor.

In the result his Lordship made the usual compulsory order for the winding-up of the company.

On the same day Mr. Justice Simonds had before him a petition for the compulsory winding-up of Day's Radio, Ltd.

Mr. Lindon, for the company, asked for an adjournment, but his Lordship made the usual compulsory order subject to the proper affidavit being filed.

COMMERCIAL AND INDUSTRIAL NEWS

Small Fluorescent Lamps. E.I.B.A. Activities. A Factories Act Exhibition. Electrical Commercial Travellers. Art School Lighting. A Works Medical Service.

Lower-wattage Fluorescent Lamps

FLUORESCENT mercury lamps of 80 and 125 W were introduced by the E.L.M.A. companies this week. Their efficiency is approximately the same as that of similar uncorrected mercury lamps, while the degree of colour correction is equal to that of the 400-W fluorescent lamp which became available rather more than a year ago. The bulbs of the new lamps like those of the 400-W lamp have to be larger than normal, as the powder loses efficiency if overheated. The 80-W lamp, with an overall length of 178 ± 5.5 mm. and a bulb diameter of 110 ± 1.5 mm. approximates in size to the 300-W tungsten lamp, while the 125-W size with a length of 233 ± 7 mm. and a diameter of 130 ± 1.5 mm. is about the same size as the 500-W tungsten lamp. The new 80-W lamp is fitted with a bayonet cap with three pins arranged at 135-90-135 deg. as in the case of the 80-W uncorrected lamp. The 125-W fluorescent lamp is fitted with a standard G.E.S. cap. As from the same date the list prices of the uncorrected lamps have been reduced by approximately 15 per cent.

The "Electrical Review" Index

The index to Vol. CXXIII of the ELECTRICAL REVIEW (July-December, 1938) is now available. Any reader who requires a copy may obtain one gratis from the Publisher, ELECTRICAL REVIEW, Dorset House, Stamford Street, S.E.1. Cloth binding cases may also be obtained at 3s. 6d. each (3s. 10d. post free).

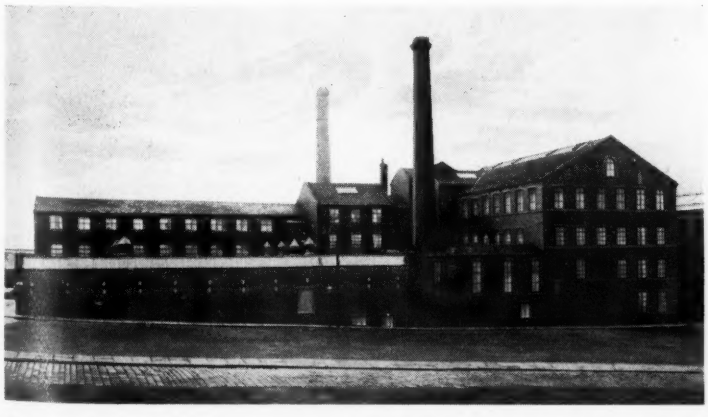
Key Industry Duty

The Board of Trade has received an application under Section 5 (5) of the Finance Act, 1936, for a licence to import free of duty one polarograph for recording electrolytic current-voltage curves obtained by the dropping mercury method, and comprising a motor-driven drum-wound potentiometer, speed regulator, series resistances, photographic recording means for use with moving coil mirror galvanometer, and voltmeter. Any representations that a similar instrument is made, or is likely to be made within a reasonable time, in the United Kingdom or elsewhere in the Dominions should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, London, S.W.1, within one month from January 25th, with details of such similar instrument (reference I.M.154/39).

E.I.B.A. Activities

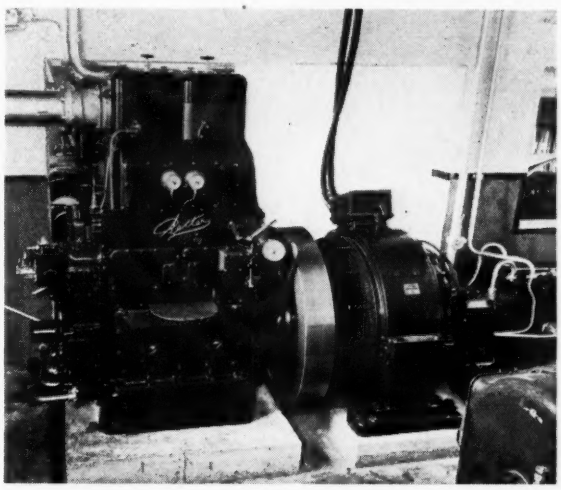
The Electrical Industries Benevolent Association will receive all the proceeds from a dramatic entertainment entitled "Charity Begins . . . ," by Ireland Wood, which will be given on February 11th and 13th at the Twentieth Century Theatre, Archer Street, W.11, by the Jackdaw Dramatic Club. Mr. L. G. Toplis, A.I.E.E., the producer, is himself a playwright. Tickets (price 3s. 6d., 2s. 6d. and 1s. 6d.) are obtainable from the secretary, E.I.B.A., 6, Southampton Place, Holborn, W.C.1.

Initial arrangements for the E.I.B.A. national golf competition for the trophy presented by Sir Montague Hughman are now completed, and entry cards (price 2s. 6d. each) can be obtained from the secretary of the E.I.B.A. or from any of the provincial addresses. The idea is that any male golfer with a club handicap of 24 or less, and who is connected directly or indirectly with the electrical industry, can play on any recognised golf course at any time between now and July 2nd, 1939, sending in as many cards as he likes, and that those returning the best cards in each area (number to be determined) will be qualified to play in the area final, the leaders in which will be able to compete at the national final on October 6th. There will also be presented a handsome trophy for each of seventeen different areas and special prizes for foursomes, for a scratch competition, a novelty being the presentation of prizes for the golfers submitting the largest number of entry cards. All the proceeds of the competition go to swell E.I.B.A. funds and will be a welcome help at a time when each year is bringing a 50 per cent. increase in the number of deserving claims upon the Association's funds.



Generation in an Aircraft Factory

An extension to the power station of the Fairey Aviation Co. at Hamble, near Southampton, has recently been made by the installation of a Petter 125-BHP 500-RPM "Superscavenge" twin-cylinder engine direct-coupled to an 84-kW, 220-V Crompton Parkinson generator. Four smaller oil-engine sets are installed (two by Petters) and the new unit runs in parallel with a Petter Atomic Diesel set of 72-kW to supply the normal power and lighting requirements of the works. Already on a number of occasions the "Superscavenge" set has been called upon to carry its full load for non-stop periods of twelve to thirteen hours. Although of greater horse-power than the older sets it occupies considerably less floor space and requires no more head room. Smooth, quiet running (assisted by the Burgess silencer) is a noticeable feature of the set.



A 125-BHP Petter "Superscavenge" Diesel engine at the Fairey Aviation Co., Ltd., Southampton

American Electrical Exports

There was a decline in United States exports of electrical machinery and apparatus during November last, the total value being $7,948,000 against $9,190,000 in October and $9,173,000 in November, 1937.

New Bradford Metal Works

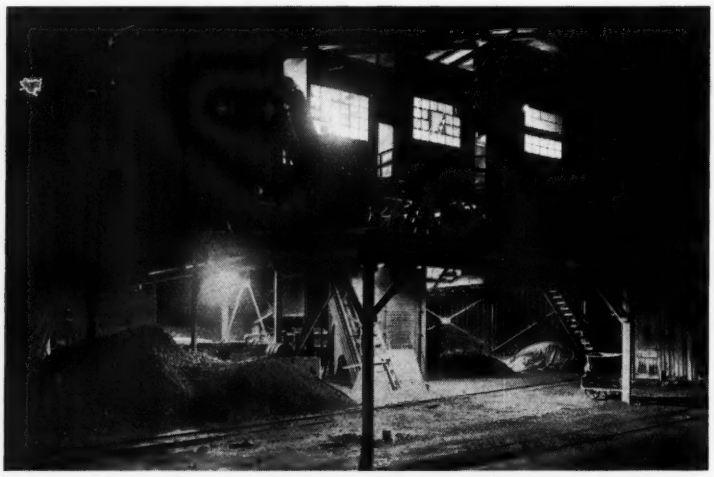
The new premises of the Bradford Metal Case Co., Ltd., electrical engineers and contractors, at Eastwood Street, Hall Lane, Bradford, known as Latem Works, have recently been completed, and are equipped for the manufacture of "Staybrite Steel" built up metal signs, oil cabinets and filters, and various plant in copper, lead aluminium and monel metal, also the B.M.C. patent domestic tank (Pat. No. 444849). The whole of the wiring work was carried out with Siemens cable by their own electrical department under the supervision of Mr. K. Nicholson, and a large number of Siemens lamps was also used for the works lighting.

The new premises of the Bradford Metal Case Co., Ltd.

Factory Lighting

The Sun Electrical Co., Ltd. (in co-operation with Benjamin Electric, Ltd.) entertained 150 electrical contractors and works engineers from the Slough area at the old Crown Hotel, Slough, on January 18th. The chair was taken by Mr. S. Harper Bill, chief engineer, Slough Estates, Ltd., who spoke of the need for a new attitude towards industrial lighting on the part of the works engineer consequent on the requirements of the Factory Act and also modern high speed production methods both of which made proper lighting essential. Mr. S. Smith, of Benjamin Electric, Ltd., then gave an informative talk on the problems of present-day illumination and the diverse methods applied

to many industries, illustrating his remarks with a series of lantern slides showing the application of various units to such widely differing industries as automobile manufacturers, printers, laundries, bus stations, woodworkers, drawing offices, petrol stations and collieries. Mr. Rule, of the Metropolitan-Vickers Electrical Co., Ltd., followed with a brief description of the development of the electric-discharge lamp. Mr. A. G. Beaver, managing director of the Sun Electrical Co., Ltd., tendered thanks to Mr. Smith and Mr. Rule.



The tar macadam plant of the Clay Cross Co., Ltd., lighted by "Philora" sodium lamps

Anglo-German Trade Relations

Arrangements have now been made for a delegation representing the Federation of British Industries to visit Germany for further discussions with the Reichsgruppe Industrie at the end of this month. It is possible that the Federation's delegation may be accompanied by representatives of certain individual industries in order that the latter may have simultaneous discussions with representatives of similar industries in Germany. The exact composition of the delegation and the place of meeting have not yet been decided.

Manchester "Factories Act" Exhibition

A "Factories Act" exhibition was opened on Tuesday last at the new Town Hall extension showrooms of the Manchester Corporation Electricity Department. In an invitation card which it is issuing the Electricity Committee states that many of the requirements of the Factories Act, are easily and cheaply met by the correct use of electricity in the form of heat, power and light, and the exhibition shows in what manner the Electricity Department can help local industries to bring their works into conformity with the Act. The exhibits include various systems of heating, ventilation, lighting, and washing and laundry facilities, and many well-known manufacturers of such apparatus have lent appliances for the exhibition. On Wednesday last Mr. G. W. Galley gave a lecture on "Works Lighting as a Productive Investment," and he is repeating the lecture on Wednesday next, February 8th.

New Showrooms and Offices at Whitehaven

The opening of the new offices and showrooms of the Whitehaven Corporation Electric Supply Department took place on Wednesday last week before a large audience, the ceremony being performed by Mr. A. East, of the Electricity Commission. The new premises are situated in the heart of the shopping centre and directly opposite those of the Gas Co. The showrooms, which have an area of about 1,500 sq. ft. and are panelled in silver grey wood, include a platform and larder, and cookery and domestic demonstrations will be given. The premises also contain a full suite of offices on the first floor for the Electricity Department, stores and domestic repair shops, and garage. They cover an area of 6,000 sq. ft. The layout was prepared by the borough electrical engineer, Mr. L. B. Hogarth, the architect being Mr. J. S. Stout. The Mayor, Councillor W. Wear, introduced the chairman of the Electricity Committee, Councillor J. Gill, who presented Mr. East with a key suitably inscribed. A dinner to celebrate the opening was afterwards held at Batty's, presided over by Councillor Gill, and among the many visitors present were Mr. F. Anderson, M.P., Councillor Armstrong (chairman, Workington Electricity Committee), Messrs. C. W. Salt (Carlisle), C. W. Emanuel (Workington) and H. W. Ashton (South Cumberland Electricity Supply Co., Ltd.).

The new showrooms of the Whitehaven Electricity Department, showing the demonstration platform

Lighting an Isolated Plant

At Ashover, in Derbyshire, is a tar macadam plant belonging to the Clay Cross Co., Ltd. The plant is completely isolated, and in order to light it the mains had to be carried for a considerable distance across open country. Economy in consumption was, therefore, of paramount importance, and for this reason Philips "Philora" sodium lighting was chosen. As a result, the lighting load for the whole of the plant—exterior and interior—amounts to only 735 W as against a calculated load of nearly 3 kW if ordinary lamps had been used to obtain the same degree of illumination. "Philora" 85-W sodium lamps were used in S.O.R.A. dispersive reflectors, the whole being supplied by the Nottingham branch of Philips Lamps, Ltd. Another factor which had to be taken into account was the considerable vibration caused by the mixing plant, which is housed in the upper floor of the building. Since they have no filaments, discharge lamps are largely immune from damage due to vibration and mechanical shock. The whole installation was planned and the work carried out under the supervision of Mr. R. W. Barnes, the chief electrical engineer to the Clay Cross Co., Ltd.

"Where to Buy"

The 1939 issue of "Where to Buy" ("Where to Buy," Ltd., 2s. 6d. post free), like its predecessors, is a comprehensive classified directory of manufacturers of electrical apparatus of all kinds. In addition to addresses, the telephone numbers of the manufacturers are given. The usefulness of the guide is increased by an alphabetical list of electrical trade names.

Electrical Commercial Travellers

The annual dinner of the Electrical Trades Commercial Travellers' Association was held on Friday last at the Connaught Rooms, W.C.2, Mr. B. Windle, chairman of the Association, presiding. Mr. Howard Foulds, in a witty speech, referred to his long association with Mr. P. V. Hunter, this year's president of the Association, and paid high tribute to his qualities as an electrical engineer. Mr. Hunter, in reply, thanked the Association for electing him to the office of president. He congratulated the members on their courage in maintaining and increasing the strength of an Association which was calculated to do so much good for their section of the electrical industry. He realised the difficulties of adding to their numbers, and was amazed to find that in each of the last two years they had increased their membership by 20 per cent. He said that he was willing to assist in every way possible a body which exhibited fellowship and a determination to achieve its objects. He had devised a scheme for helping the Association financially during the coming year. He confessed to an occasional bet when taking part in a golf match, and proposed to hand over to the Association any proceeds which might accrue from this source during the ensuing year, presenting the chairman with two cheques totalling £11 15s. as his initial contribution. He hoped that he would be asked to attend their annual dinner at a time when their numbers would have so grown that the largest room in the city would be required to accommodate their members.

Mr. T. W. Heather, in proposing the toast of "The Association and its Charities," mentioned that the Association had been in existence for thirteen years and that it had a membership of nearly 300 which indicated that it was virile and strong. During its existence it had contributed about £1,000 to the charities in which it was interested, namely, the

E.I.B.A., the Royal Commercial Travellers' Schools and its own benevolent fund. He paid tribute to the work of Mr. S. Johnson, the hon. charity steward, for his work in the cause of charity. Mr. Johnson, in responding, referred to the Association's efforts to help its charities, and also the help which it was able to give members in time of need, and appealed for liberal support in order that it could meet any demand which might arise in possible years of depression. The toast of "The Visitors" was proposed by Mr. B. E. Crow and replied to by Mr. R. Lee. Mr. E. North (past chairman) proposed "The Chairman and Officers" and Mr. Windle responded. A collection made during the evening realised nearly £16.

New Electricity Offices at Taunton

New electricity offices and showrooms will be opened at Taunton on February 8th.

London Electrical Domestic Science Old Students

The fourth annual dance of the London School of Electrical Domestic Science Old Students' Association will be held on February 24th at Princes Galleries Suite, Piccadilly, W.1. Tickets (10s. 6d. each) can be obtained from Miss Syme at Imperial Court, Basil Street, Knightsbridge, London, S.W.3.

Works Visit

Forty-one members of the Bradford Branch of the Electrical Association for Women were recently shown over the new Crompton lamp factory and glassworks at Guiseley, Leeds. Not only were they shown the production of general lighting service lamps through all stages, but also of special types, such as striplights, mercury discharge lamps, &c. The visitors were impressed by the pleasant conditions under which the many operatives work in this model factory.

E.C.A. (Colchester Branch)

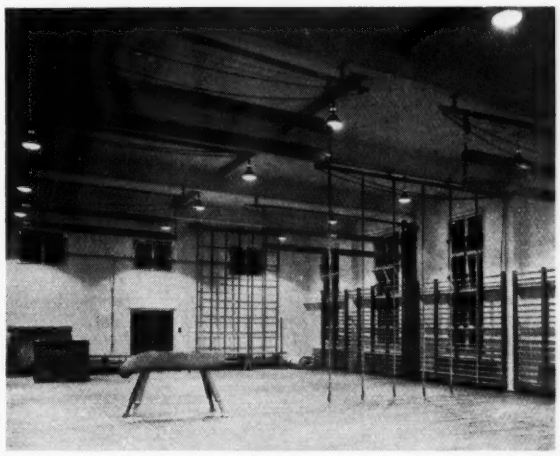
The Colchester Branch of the Electrical Contractors' Association, in conjunction with the local branch of the E.I.B.A., is holding a dinner and dance on March 29th at the Red Lion Hotel, Colchester, in aid of the Electrical Industries Benevolent Fund. Tickets (10s. 6d. single and 20s. double) can be obtained from either Mr. B. L. Kay, hon. branch secretary, E.C.A., 14, Harsnett Road, Colchester, or Mr. W. J. Dyde, hon. local secretary, E.I.B.A., 152, Brook Street, Colchester.

Lighting an Art School

Special arrangements to secure high intensity general and local lighting make the electrical installation just completed by the London County Council at the new St. Martin's School of Art and Technical Institute for the Distributive Trades in Charing Cross Road, W.C.2, of particular interest. In addition to the generous number of industrial type pendant fittings (Benjamin, Crossland "Croslac" and Frederick Thomas) provided in the classrooms, considerable use is made of Mek-Elek adjustable units fixed to the walls. In some of the rooms on the fifth floor rectangular trough fittings (Major Equipment Co.) are arranged so that they can be adjusted to any desired angle and also slid on rails to the particular position required. Indirect lighting on the landings comes from attractive units made by Davis Bros., while for the assembly hall decorative circular pendants have been constructed by Holroyd (Glassware and Lighting), Ltd., to the design of the L.C.C. architects. Disappearing footlights are another feature of the assembly hall, the fittings (Davis Bros.) being mounted on hinges which enable them to be closed up into drawers let into the edge of the stage. Signals for class changing are given automatically, coloured lights over the doors being operated in conjunction with the Synchronome electric clock system. Other electrical equipment used in the installation included Henley paper insulated and v.i.r. cables, Longmore Bros. conduit, "Osram" lamps, Dorman & Smith main distribution gear and main switchboard, Mantel Metalworkers' main switchboard assembly and special bus bar chambers, and an Airedale main circuit breaker. The electrical installation was carried out by the Berkeley Electrical Engineering Co., Ltd., under the supervision of the L.C.C.'s Engineering Department.

Gymnasium Lighting

The accompanying illustration shows the gymnasium at King Alfred's Training College, Winchester, in which a new Holophane lighting scheme has been installed. The lighting



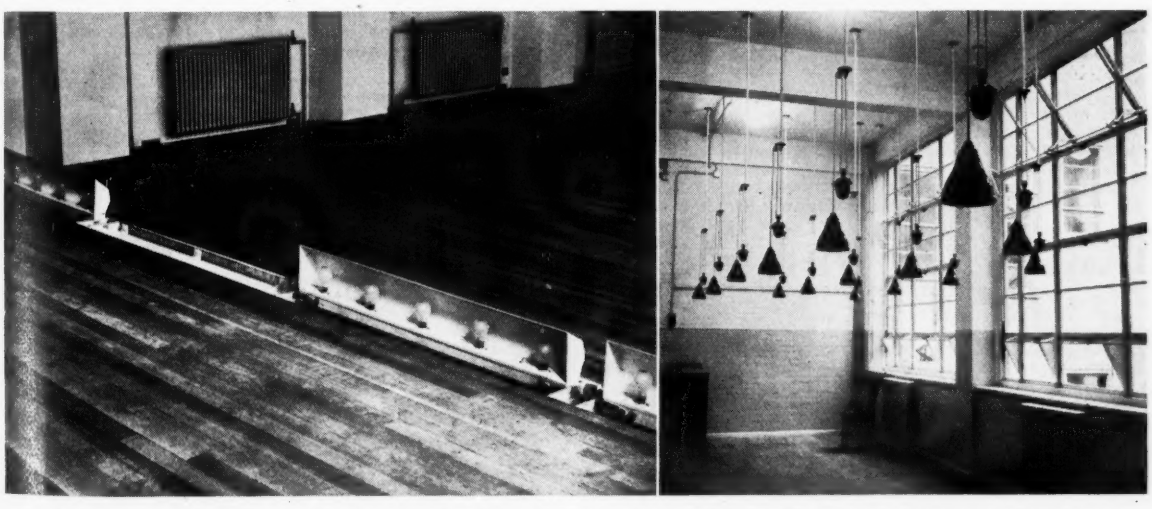
Holophane lighting in the gymnasium of King Alfred's Training College, Winchester

was carried out by means of heavy duty reflectors, with wire guards fixed close to the ceiling to give a high intensity lighting effect upon the floor.

Conjoint Conference of Public Utility Associations

At the seventh annual meeting of the Conjoint Conference of Public Utility Associations held on January 26th, Lord Falmouth was unanimously elected president in succession to Lord Mount Temple. Sir David Milne-Watson, Mr. William Cash and Lord Pentland were elected vice-presidents. Lord Falmouth said that constituent members represented a capital expenditure of well over £1,000,000,000 and consumed upwards of 35,000,000 tons of coal per annum. They had nearly 300,000 miles of mains laid and employed 200,000 men directly in their undertakings. It was often stated that sheltered industries were apt to become sleepy after a time and were little disposed to adopt new ideas, but this was certainly not true of water, gas or electricity. One of the outstanding recent developments was the reduction in the amount of coal consumed per kWh generated. It had saved the nation many hundreds of thousands of pounds per annum. The capacity of both the gas and electricity undertakings in meeting the large extra demand made on them during the recent cold weather was also very striking. Every advantage of modern science and scientific research was being used still further to improve the services to the public. In no way had the Conference justified itself more than in its efforts to secure fair treatment for its members.

One matter that had been causing great anxiety to all public utility undertakings was the rise in operating costs, especially coal costs. The Conference was endeavouring to secure that those who were representing consumers on the Committee of



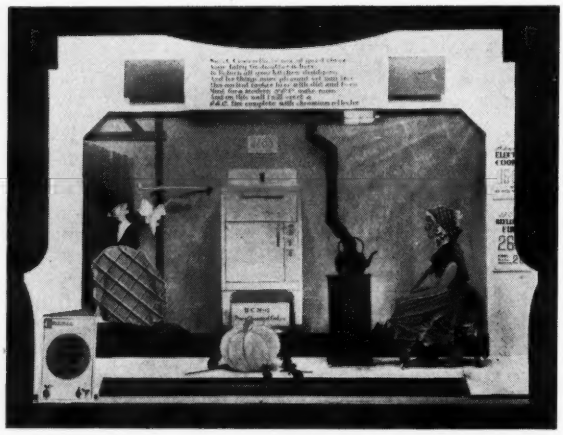
Good lighting is a feature of the new St. Martin's School of Art and the generous installation of adjustable ceiling units in one of the classrooms is shown in the right-hand illustration. Left: Disappearing footlights in the assembly hall stage

Investigation set up under the Coal Mines Act should be fully representative. One further matter of interest was Air Raid Precautions and he was glad that agreement had now been reached between the Government and the utilities as to the special defence precautions. Members had shown a proper spirit of patriotism in agreeing to shoulder 50 per cent. of the additional cost to be incurred.

Among matters dealt with in the annual report of the Conference were: Legislation relating to coal, hire-purchase, housing finances, and street playgrounds; rating and valuation; mains and cables in highways; revenue and expenditure of municipal trading undertakings, allocation of costs in connection with private Bills; and the lighting of obstructions in carriageways.

Topical Window Displays

Excellent examples of topical window displays are to be seen at the Magnet House, Kingsway, windows of the General Electric Co., Ltd. Each of these has a favourite pantomime character as its central figure and features G.E.C. household appliances. The four characters used are Cinderella, Aladdin, Ali Baba, and Man Friday. Cinderella is depicted sitting over her old-fashioned solid-fuel stove waiting for her kettleful of water to boil while in the foreground are the four mice, complete with pumpkin. Cinderella is just being visited by her fairy godmother. In the background is a screen of



A G.E.C. Cinderella window display at Magnet House, Kingsway

gauze and every two or three seconds the space behind this is illuminated revealing a model of the G.E.C.'s new cooker, the DC.100, and a G.E.C. reflector fire. Next to Cinderella is Aladdin who, of course, is making good use of his magic lamp. Ali Baba is the central character in the third display, while at each side of the window are some of the forty thieves in their oil-jars. This display brings in vacuum cleaners. In the fourth window Man Friday is kneeling in the sand holding a cup and saucer as Robinson Crusoe approaches on a raft, and the setting provides an opportunity to introduce smaller appliances such as electric toasters, coffee percolators, and electric kettles.

Change of Name

H. Webb & Co. (Engineers), Ltd., have changed their name to Hotric, Ltd.

Trade Announcements

Heat & Air Systems, Ltd., of 172, Buckingham Palace Road, S.W.1, announces that after April 17th it will not be restricted to the use of U.S.A. refrigeration equipment in the design of air conditioning plants as its agreement with the Westinghouse Electric International Co. of New York terminates on that date.

Flinders (Wholesale), Ltd., has opened a new electrical showroom at 69-71, Regent Street, Cambridge.

Gaston E. Marbaix, Ltd., 22, Carlisle Place, London, S.W.1, have been appointed representatives in Europe for the "Greenlee" spiral screwdriver.

Sterling Works (Dagenham), Ltd., has changed its name to the Sterling Engineering Co., Ltd., and will handle all products previously dealt with by Ismay Distributors, Ltd., John Ismay (Neon Signs), Ltd., Ismay (New Process) Lighting, Ltd., and Lumolite, Ltd.

The New Blackburn Electricity Offices

Ald. W. Walker (Manchester), a member of the Central Electricity Board and chairman of the National Joint Committee, speaking at the opening of new Electricity Offices at Blackburn on January 31st, said he believed it was likely in the near future that Blackburn would be called upon to erect a new station—a selected station under the Act. Sir Cyril Hurcomb, chairman of the Electricity Commissioners, put in a plea for the substitution of trolley vehicles instead of petrol buses when trams were dispensed with. He said that the trams were doomed to disappear, but they still provided an important load for electricity undertakings. He understood that locally the amount of electricity bought for the trams was gradually being reduced under a programme of replacement by petrol buses, which, if carried through, would deprive the electricity undertaking of a revenue of over £12,000 per annum.

An Explanation

In order to avoid any possible misunderstanding which may arise, Superlamp, Ltd., asks us to point out that the official notice of members winding up which appears in the *London Gazette* and various trade journals refers only to the old company of Superlamp, Ltd., and has no connection at all with the present company. All accounts are being settled in the usual manner.

E.A.W. Activities

The recently constituted Electrical Association for Women's Business and Professional Women's Circle held its first annual general meeting on January 23rd in London. The new group comprises the former Teachers' and Demonstrators' Circles, but it is hoped that the new constitution will widen its scope to include architects, nurses and women engaged on the clerical side of the electrical industry.

Eighty people were present at the inaugural meeting of the Wimbledon unit at the Town Hall last Friday. The Mayor presided and the speakers included Alderman Hickmott, Miss Caroline Haslett (director), Mr. W. J. Oswald, Miss Pledge (hon. secretary), and Mrs. R. W. Kennedy (chairman).

Purchase of Cable Works

It is now confirmed that the works of Ismay Cables, Ltd., at Dagenham, have been purchased by the Cable Makers' Association.

Domestic Appliance Directory

In the "Directory of Domestic Electrical Appliances and Diary for 1939" (*Electrical Trading*, price 2s. 6d.) there are more than 20,000 references. Names, addresses and telephone numbers of manufacturers, wholesalers and a list of brand names are given, and the buyers' guide offers easy access to the names of manufacturers of nearly 200 different types of domestic electrical appliances. Details of the Hire Purchase Act, 1938, are included, and a diary has been added.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, ETC.	Price February 1st.	Fortnight's inc. or dec.
a	Acid Oxalic ... ... per cwt.	50s.	—
a	Ammoniac, Sal ... ... per ton	£37	—
a	Ammonia, Muriate (large crystal)... ,,	£18 10s.	—
a	Borax... ... ... ,,	£17	—
a	Copper, Sulphate ... ... ,,	£19	—
a	Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a	,, Perchlorate ... ... ,,	6d.	—
a	Shellac ... ... per cwt.	£4 8s.	—
a	Sulphur, Commercial ... ... per ton	£11	—
a	,, Roll ... ... ,,	£11	—
a	Soda, Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a	,, Crystals ... ... per ton	£5 to £5 5s.	—
a	Sodium, Bichromate, casks ... per lb.	4¼d. net.	—
	METALS, ETC.		
b	Aluminium, Ingots ... ... per ton	£94	—
b	,, Wire ... ... per lb.	1/1 to 1/9	—
b	,, Sheet and Foil ... ,,	1/2½ to 2/9	—
p	Babbits Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£107	£3 dec.
	Grade II ... ... ,,	£137	£3 dec.
	Grade III ... ... ,,	£72	£4 dec.
c	Brass (rolled metal 2" to 12" basis)... per lb.	8¼d.	—
c	,, Tubes (solid drawn) ... ... ,,	11½d. to 11¾d.	—
c	,, Wire, basis ... ... ,,	8¼d.	—
c	Copper Tubes (solid drawn) ... ,,	1/0¾d.	—
g	,, Bars (best selected) ... per tonM	—	—
g	,, Sheet ... ... ,, M	£78	£2 dec.
g	,, Rod ... ... ,, M	—	—
d	,, (Electrolytic) Bars ... ... ,,	£48 10s.	10s. dec.
d	,, ,, Wire Rods ... ,,	£53 5s.	10s. dec.
d	,, ,, H.C. Wire ... per lb.	7½d.	1/16d. dec.
f	Ebonite Rod ½" dia. & up. ... ,,	1/10 to 2/5	—
f	,, Sheet ×" thick & up ... ,,	1/5 to 1/10	—
n	German Silver Wire, Nos. 1 to 12... ,,	2/4	—
h	Gutta-percha, fine ... ... ,,	Nom.	—
h	India-rubber, Para-fine ... ... ,,	6¾d.	½d. dec.
i	Iron, Pig (Cleveland, No. 3) ... per ton	£4 15s.	—
i	,, Wire galv. No. 1 P.O. Qual.... ,,	£23	—
g	Lead, English Pig ... ... ,,	£16 15s.	5s. inc.
g	Mercury ... ... per bot.	£15	—
e	Mica (in original cases) small ... per lb.	10d. to 2/–	—
e	,, ,, ,, medium ... ,,	6/– to 12/6	—
e	,, ,, ,, large ... ,,	13/– to 17/6 up	—
p	Phosphor Bronze, plain castings ... ,,	1/2½	—
p	,, ,, drawn bars & rods ,,	1/1d.	—
p	,, ,, rolled strip & sheet ,,	11½d.	—
p	,, ,, wire ... ... ,,	1/1½d.	—
o	Platinum ... ... per oz.	£7 10s.	—
d	Silicum Bronze Wire ... ... per lb.	8½d.	¼d. dec.
g	Spelter ... ... per ton	£13 15s.	3s. 9d. dec.
g	Tin, Block (English) ... ... ,,	£216 10s.	£1 10s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/6	—

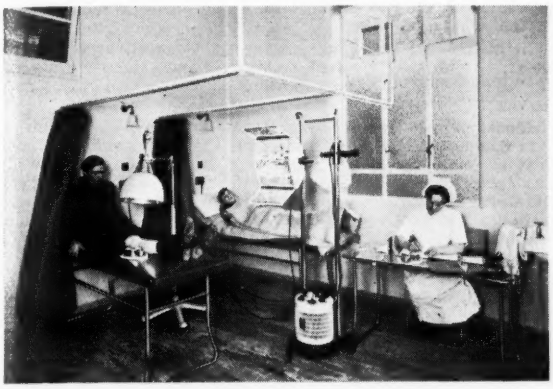
Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicum bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in this section under the same heading.

A Works Hospital

The fundamental objects of a works medical service vary little in the different industries, but in planning a hospital in which a works medical service can function it is necessary to take into account the particular hazards of the industry concerned. The nature of the work of the Pressed Steel Co., Ltd., Cowley, Oxford, is such that the two great hazards are incised and lacerated wounds, due to contact with steel sheets, pressings, &c., and foreign bodies in the eyes due to the discing and polishing of metal that is necessary before paint can be applied to produce that sheen which is associated with good body finish. The new hospital of the company contains a surgical block consisting of a waiting room, large surgery and operating room. There are wards for male and female patients, and a large combined X-ray and dark room, where



A corner of one of the departments of the hospital of the Pressed Steel Co., Ltd.

patients can be radiographed and where eye cases can be dealt with. There is bound to be a certain number of cases of strains of ligaments, tendons and joints, and these are dealt with in a room set aside for physio-therapy, where treatment by infra-red and ultra-violet rays can be given as well as massage. There is a very fully equipped consulting room, and in the near future a dental clinic will be functioning. The rooms of the hospital are painted in warm colours, while the floors are of a grey green terrazo. The surgical equipment is of stainless steel, and the furniture is of chromium-plated tubular steel. Dr. H. K. Rowntree is chief medical officer of the company.

The Building Centre (Scotland)

Harcourts, Ltd., have a display of lighting fittings on their stand No. 23/2 at the Building Centre (Scotland).

New Catalogues and Lists

Robert Hornby & Co., Ltd., 7, Carlisle Street, Dean Street, London, W.1.—A brochure describing maximum demand meters and signalling apparatus.

British Thomson-Houston Co., Ltd., Rugby.—A 56-page illustrated catalogue of motors and control gear.

Bruce H. Auld & Co., Ltd., 161, Stafford Road, Croydon.—Leaflet No. 396 describing a new ozoniser for small refrigerating chambers.

C.A.V.-Bosch, Ltd., Acton, London, W.3.—Details of piston type shock absorbers for commercial vehicles.

Wilmot-Breeden, Ltd., Eastern Works, Camden Street, Birmingham, 1.—A catalogue dealing with new "Oscillith" bushes for flexible couplings and anti-vibration mountings.

Young & Wildsmith, Ltd., 35, Little Russell Street, New Oxford Street, London, W.C.1.—A 20-page pocket price list of electrical accessories and a 32-page illustrated catalogue of electrical fires.

Crofts (Engineers), Ltd., Thornbury, Bradford.—Catalogues giving full details and diagrams of variable speed drives of various kinds.

Sun-Vic Controls, Ltd., Stanhope House, Kean Street, Aldwych, London, W.C.2.—A booklet dealing with a battery trickle charging relay, a load limiting relay and an energy regulator for furnace control.

Private Arrangements

Universal Radio Distributors, Ltd., London, W.—An informal meeting of the creditors was held recently, having been convened by Mr. L. V. Smith, 25, Oxford Street, London, W. who was appointed as receiver by the debenture-holders on January 9th. An approximate statement of affairs was submitted, which showed ranking liabilities of £16,925. The net assets were £13,801, leaving a deficiency, so far as the creditors were concerned, of £3,124. It was stated that some little time ago certain of the larger creditors were approached with a view to some scheme of arrangement being entered into. Proceedings were, however, commenced against the company, and the debenture-holders appointed a receiver. After discussing the position it was decided that a committee should be appointed to consider the matter and co-operate with the receiver for the debenture-holders in submitting a scheme to the creditors.

A. C. Ryall, trading as Ryall's Radio, Rutland Road, Hove.—The creditors were called together recently when a statement of affairs was submitted showing liabilities of £560, all due to the trade, and total assets of £292, leaving a deficiency of £268. An offer was made of a composition of 9s. in the £, payable in cash, which it was decided to accept.

Bankruptcy Proceedings

C. R. Miskin (trading as Miskin & Rice), Bush House, Aldwych, W.C., and lately at 31, Windmill Street, W., electrical contractor.—This debtor applied for his discharge at the London Bankruptcy Court on January 27th before Mr. Registrar Parton. He failed in February, 1936, with liabilities of £1,139 and assets which had realised £6, although he had estimated them to produce £89. The discharge was suspended for six months.

D. Beck, formerly carrying on business at 96, Harris Street, Bradford, and lately carrying on business under the name of Electrical & Hardware Appliances, electrical appliances dealer.—The public examination was held at the County Court House, Albion Place, Leeds, on January 24th. Debtor said that when he commenced business two years ago he had a capital of £10, and his deficiency now amounted to £234. The examination was closed.

B. Harris (Central Radio), radio dealer, 144, Kingsland High Street, E.8.—Receiving order made January 25th on debtor's own petition. First meeting February 8th and public examination April 20th, both at Carey Street, W.C.2.

C. Oldfield, 45, Silver Street, Manningham, Bradford, formerly carrying on business at 136a, Listerhills Road, Bradford, as a radio dealer.—Receiving order made January 25th on debtor's own petition.

H. M. Brown, electrical engineer, 97, St. Helens Street, Ipswich.—Receiving order made January 21st on debtor's own petition.

V. E. Cazeaux, electric lamp dealer, 359, Strand, London, W.C.2.—Receiving order made January 20th on a creditor's petition. First meeting February 3rd, and public examination March 8th, both at Bankruptcy Buildings, Carey Street, W.C.2.

R. W. Bradley and **B. R. Bradley** (W. Bradley & Sons), electrical contractors, 75, York Road, Woking.—Receiving order made January 18th on debtor's own petition.

F. A. Scottorn, engineer and electrician, 18, Friars Street, Ipswich.—Receiving order made January 19th on debtor's own petition. First meeting February 9th at 13a, Great Colman Street, Ipswich. Public examination March 10th at the Shirehall, Ipswich.

M. R. Horne (Malcolm & Stewart), radio and electrical retailer, 491, Alum Rock Road, Birmingham.—Last day for receiving proofs for dividend February 10th. Trustee, Mr. R. K. Clark, 37, Temple Street, Birmingham, Official Receiver.

G. F. Barnes, electrical and radio engineer, 1,102, London Road, Leigh-on-Sea.—Receiving order made January 19th on debtor's own petition.

W. L. M. Jones, wireless dealer, 118, High Street, Blackwood, Monmouth.—Public examination February 16th at the Town Hall, Tredegar.

R. A. Bowles, radio dealer, 82, Oriel Drive, Aintree, Liverpool, and lately trading at 2, Sefton Road, Litherland, Liverpool.—Last day for receiving proofs for dividend February 8th. Trustee, Mr. J. Allcorn, Government Buildings, Victoria Street, Liverpool.

H. Etherington, electrical and refrigerating engineer and contractor, Lawn Villa, Moorgate, and 104, Micklegate, both York.—Application for discharge to be heard on March 14th at the Law Courts, York.

Company Liquidations

J. Sharp & Co. (Prestwich), Ltd.—Meetings, February 28th, at 33, Blackfriars Street, Manchester, to receive an account of the winding-up by the liquidator, Mr. G. W. Street.

L. B. & D. Electrical Co., Ltd.—Winding up voluntarily. Joint liquidators, Mr. C. Latham, 185, High Holborn, and Mr. S. Sharpe, 49, Bedford Row, London.

Bindleys, Ltd.—Particulars of claims by February 14th to the liquidator, Mr. T. C. Bindley, 284, Blackpool Street, Burton-on-Trent.

TRADE MARK APPLICATIONS

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 25th:—

Super S. (lettering and design). No. 586424. Class 6 (III). Motors, boring, grinding, sawing and shearing machines, and fans, all electrically driven, and none being for agricultural or horticultural use.—Alexander Schönwald, Berlin, W.15, Germany (British representatives, Edward Evans & Co., 40-43, Chancery Lane, London, W.C.2).

Alambra. No. 602664. Class 9 (IV). Primary and secondary electric cells and batteries.—Alpha Accessories, Ltd., Lockfield Avenue, Brimsdown, Enfield, Middlesex.

Flashtest (lettering and design). No. 600987. Class 9 (IV). Instruments embodying neon tubes for testing electric current.—Atlanta Appliances, Ltd., 132, Southwark Street, S.E.1.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

BACTEROL steriliser cabinet.
EPIC toaster.
LABINAL panel for mounting fuses.
WALCO spacing saddles for conduit.
JEROBA clothes dryer.

ELECTRICITY SUPPLY

Floods at Ipswich. Lincolnshire Rural Supplies. Large Transmission Schemes in the London Area. Power Station Extensions at Oban.

Barking.—LOAN.—Application is to be made by the Electricity Committee for sanction to borrow £10,000 for apparatus for hire.

TESTING EQUIPMENT.—The Electricity Committee is to purchase high-voltage testing equipment at a cost of £366.

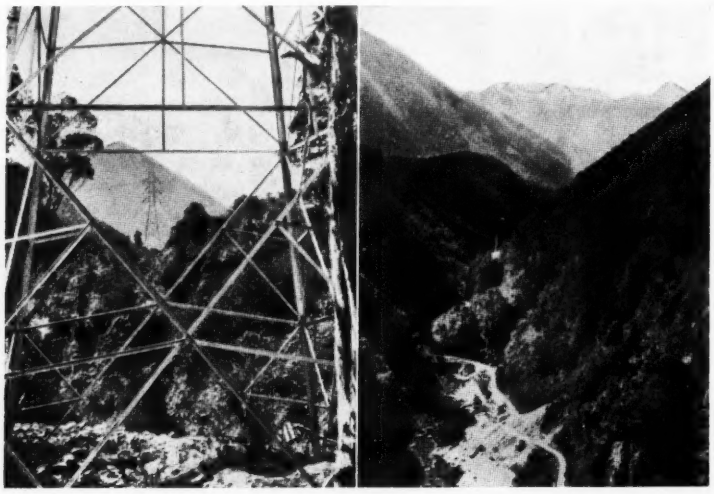
Bexhill.—STRENGTHENING DISTRIBUTION.—Approval has been given to spend £10,932 on work in connection with existing supplies and to meet anticipated additional requirements.

Chelmsford.—STREET LIGHTING.—The Rural District Council has decided to retain the improved street lighting in Baddow Road, Great Baddow, installed experimentally by the County of London Electric Supply Co., Ltd.

Chester.—ILLUMINATIONS.—The city electrical engineer (Mr. S. E. Britton) has submitted to his committee proposals for the Chester illuminations for 1939. The suggestions include the holding of a season of illuminations from September 2nd to October 8th, 1939, the scheme being concentrated entirely on the illumination of the River Dee.

Clitheroe.—SUPPLY TO DAIRY.—The Town Council is to afford a supply of electricity to the dairy of the Co-operative Wholesale Society at Chaigley.

Corby (Northants).—PUBLIC LIGHTING.—The Electricity Department's quotation of £751 for an improved lighting scheme in Rockingham Road, Corby, providing for thirty-one 250-W mercury-vapour lamps from the Jamb to Studfall Avenue, has been accepted subject to a proviso that the work be completed by the middle of February. Similar lighting has already been installed in other parts of Corby, and to give the Council an idea of the liability it would have to face if all the main streets of Corby were lighted to a similar standard, information has been obtained from Kettering Electricity Department and Kettering Gas Company as to the cost of a comprehensive scheme to include Rockingham Road, Cottingham Road, High Street, and part of Weldon Road.



Otira Gorge, New Zealand, on the route of the new Lake Coleridge-Arahura transmission line for the West Coast electrification scheme **(see page 158)**

Cullen (Banffshire).—ELECTRICITY INAUGURATED.—Electricity has now been switched on in the village. The new system has been in use for the past few weeks in the town generally but it was not till this week that the main trunk road and other principal streets of the town were lighted for the first time by electricity. The Aberdeen Electricity Committee has approved a scheme for the extension of the mains to Banchory Devenick on the south side of the Dee.

Durham.—FLOODLIGHTING SCHEME.—The City Chamber of Trade has a suggestion under consideration for the floodlighting of Durham Cathedral and Castle.

Failsworth.—ELECTRICITY FOR STREET LIGHTING.—At a recent meeting of the Council a resolution was confirmed that at the expiration of the contract with the Oldham Gas Department for the lighting of Oldham Road, the thoroughfare should be lighted by electricity.

Finchley.—NEW DISTRIBUTORS.—The Electricity Committee is to replace distributors in the Holly Park and Windsor Road areas at a cost of £2,362.

Ilford.—SUB-STATION EQUIPMENT.—The Electricity Committee is seeking sanction to borrow £10,000 for sub-station equipment.

Ipswich.—FLOODS SURROUND POWER STATION.—During the serious flooding which occurred at Ipswich last week the power station became completely surrounded. On Thursday the men on the day shift were unable to leave and carried on work during the night in place of the night shift who could not get to the power station.

Kettering.—NEW SWITCH HOUSE.—Plans are to be prepared for the erection of a new switch house at the Rockingham Road generation station estimated to cost £9,000, inclusive of a new 6,600-V feeder cable. The proposed buildings will front on to the main street at some little distance from the other buildings, so that should a serious outbreak of fire occur in the existing switch room the proposed works would ensure a continuance of the supply.

Leicester.—MAINS.—The Electricity Committee will next week, at the City Council meeting, report the necessity of providing £150,000 for expenditure on unspecified mains and services.

Lincolnshire.—INQUIRY INTO RURAL SUPPLIES.—A statement was made at a recent Caistor Rural District Council meeting that an inspector of the Electricity Commission would visit the area at the end of the month to inquire into the question of electricity supplies in the villages round Caistor which have not yet received a supply of electricity. These include Bigby, Grasby, Somerby and Searby-cum-Owmby.

London.—HACKNEY.—The Electricity Committee is seeking sanction to borrow £50,000 for domestic apparatus. Mr Herbert S. Morrison, M.P., is to perform the opening ceremony of the extensions at the generating station on Saturday, March 11th.

POPLAR.—The coal-handling plant is to be improved by the Electricity Committee at Watts Grove generating station at a cost of £2,096. The Electricity Committee has investigated the possibility of adopting a scheme of outside lighting for small shops in the borough and is of opinion that the provision of lanterns on a simple hire basis is most likely to appeal to local tradespeople. In conjunction with the installation of the lanterns, efforts will be made to brighten the immediate surroundings by improving the general street lighting, especially in the side streets where shops are not easily discernible from the main road. It proposes that all local shopkeepers be offered 300-W outside lanterns indicating their name and business for a hire charge of 2s. 6d. per lantern per month, the current consumption being at the running charge already existing at the shop premises. The lanterns will be fitted and maintained free of charge.

ST. PANCRAS.—It is recommended that application should be made by the Borough Council for sanction to a loan of £844 for high-voltage switchgear at the Queen's Crescent sub-station.

HAMMERSMITH.—A three-phase supply is to be given to the factory of Bloctube Controls, Ltd., at an estimated cost of £300, and to the Triplex works at a cost of £437.

STOKE NEWINGTON.—A new AC cable is to be laid in Matthias Road to supply flats being erected on the Hewling Street site. The cost is estimated at £627.

LEWISHAM.—At the end of last month under the contract for improving the lighting of side streets the South Metropolitan Electric Light and Power Co. had erected 279 200-W and 560 150-W lamps, and 556 gas lamps were taken out of commission.

SCHOOL LIGHTING.—The L.C.C. Education Committee is to install electric lighting at Townmead school, Fulham, and at Earlsfield school, Wandsworth.

J.E.A. RATING ASSESSMENT.—The London and Home Counties Joint Electricity Authority has decided to obtain counsel's opinion on the terms of the award of Sir Walter Monckton, K.C., the arbitrator on its rating assessment.

NEW TRANSMISSION LINES.—At last week's meeting of the Authority it was reported that the Metropolitan Electric Supply Co. had applied to the Electricity Commissioners for their consent to the laying of additional transmission cables between sub-stations at Uxbridge, Hayes and Amersham, at a cost of £135,250, to deal with next winter's increased load.

REINFORCEMENT OF SURBITON NETWORK.—The second stage of a general scheme for the reinforcement of the J.E.A.'s 11-kV network at Surbiton to meet future developments, estimated to cost £8,000, was to have been carried out next year but has been brought forward to the current year and extended by £2,000 to provide a link between the Surbiton 33-kV supply at Hollyfield Road and the Esher, Walton and Weybridge 11-kV supply at the Portsmouth Road sub-station.

Manchester.—FIRE PRECAUTIONS.—Fire-extinguishing equipment is to be installed by the Electricity Committee at certain sub-stations at a cost of £12,000.

Milnrow.—ELECTRIC STREET LIGHTING.—The Urban District Council has decided to convert the remaining street lamps from gas to electricity.

Oban.—EXTENSIONS TO GENERATING STATION.—The Electricity Committee has decided to go ahead with the preliminary arrangements in connection with the proposed extension of the electricity station at a cost of £40,000.

Oldham.—JOINT CONTROL OF ELECTRICITY AND GAS DEPARTMENTS.—The Town Council has considered a proposal for the merging of the commercial management of the Electricity Department with the Gas and Water Departments. The matter has been referred to the Electricity and Gas and Waterworks Committees for their observations. If any of the committees be averse to the change, they will be required to give their reasons.

Rawtenstall.—METERS.—The Electricity Committee is seeking sanction to borrow £5,000 for meters.

Salford.—SUB-STATIONS.—Sanction is being sought by the Electricity Committee to a loan of £10,000 for sub-stations.

Skegness.—NEW SUB-STATION.—The Town Council has approved plans for the erection of sub-station in Tower Gardens by the Mid-Lincs Electric Supply Co., Ltd.

Southend-on-Sea. — ELECTRICITY AT CREMATORIUM. — The borough electrical engineer is preparing a scheme for the installation of electrical plant in the proposed crematorium.

Stockton-on-Tees.—SUB-STATION.—The Town Council proposes to erect a sub-station in Oxbridge Avenue at a cost of £1,800, including equipment.

Stoke-on-Trent.—BULK SUPPLY.—At a recent meeting of the Electricity Committee it was reported that the North-West Midlands Joint Electricity Authority had decided not to take any further action in connection with a suggestion that bulk supply at 33,000 V should be afforded to the Authority at Burslem.

NEW EQUIPMENT.—The Electricity Committee is seeking sanction to borrow £50,000 for hired apparatus; £9,500 for switchgear and £4,400 for a sub-station at Bucknall Cross Roads.

Sunderland.—LARGE EXTENSION SCHEME PROPOSED.—The Electricity Committee is recommending the Town Council to agree to a £450,000 extension scheme at the generating station.

Sutton Coldfield.—SUPPLY FOR BALLOON BARRAGE CENTRE.—The Electricity Committee is to provide a supply to the proposed new balloon barrage centre, Whitehouse Common Farm, at a cost of £1,429.

Todmorden.—OVERHEAD LINES.—No objection is to be offered by the Rural District Council to the erection of overhead lines at Hudson Mill by the Electrical Distribution of Yorkshire, Ltd.

Wallasey.—SUB-STATION.—The Electricity Committee is to erect a sub-station in Grove Road.

West Bromwich.—LOAN.—Sanction is being sought by the Electricity Committee to a loan of £20,000 for meters and £12,000 for services.

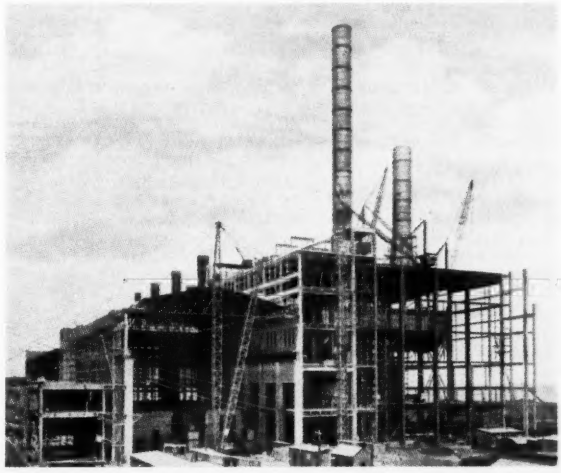
Wimbledon.—NEW EQUIPMENT.—The replacement of switches in certain sub-stations by others of higher rupturing capacity is to be carried out by the Electricity Committee at a cost of £5,000. It is also to complete the feeder transformer unit at the Malden sub-station at a cost of £28,101 and engage Merz & McLellan as consulting engineers. New sub-stations are to be provided and alterations and additions made to certain existing sub-stations at a cost of £14,710.

Overseas

Eire.—PROGRESS OF THE LIFFEY SCHEME.—The Electricity Supply Board announced last week that it is about to commence civil constructional works in connection with the Liffey hydro-electric scheme which will supply both electricity and water to Dublin. It has arranged a series of maps and a book of reference showing the occupiers of lands and other properties who are likely to be disturbed by these works, which include the construction of a dam about 100 ft. deep above the falls at Poulaphouca. The total head available will be about 220 ft., of which about 165 ft. will be used in a power station 300 yd. below the falls, while about 55 ft. will be used in another station about a mile below the falls. A tunnel is being driven through a hill to bring the water from the reservoir to the Poulaphouca power station. The estimated output in an average year has been computed at 30 million kWh. The installed capacity will be 30,000 kW at the Poulaphouca station and 4,000 kW at the Golden Falls station.

ELECTRICITY AT HAULBOWLINE.—The work of linking up the island of Haulbowline in Cork Harbour with the electricity supply of the mainland has just been commenced, and linesmen are engaged in erecting poles between Kilbarry supply station in Cork and Paddy's Block, near Ringaskiddy. A 38,000-V submarine cable is being laid from Paddy's Block to the island to supply the new steel rolling mills there. The cost to the E.S.B. will be over £30,000.

Northern Ireland.—E.S.B. PROGRESS DURING 1938.—An increase of 5.75 per cent. in kWh purchased during 1938 as compared with 1937 is reported by the Electricity Board for Northern Ireland. In 1932 the number of kWh purchased and generated was 3,368,000; in 1937, 46,264,000; and in 1938, 49,000,000. The Board, whose activities are confined to areas outside Belfast and Londonderry, had a total of 39,220 consumers at December 24th, 1938, an increase of 3,435. The Board states that 1938 was marked by the continued change from other power methods to electricity by quarry owners, and by the advance which is being made in the heating of halls and churches by electricity. The low capital cost of this method, combined with the ease of operation and thermostatic control, is making a strong appeal. The increase in the use of electricity in hospitals for lighting, cooking and heating has been noteworthy. It is also gratifying to report marked advance in street lighting. The progress of the Board has in very large measure been due to the Government guarantee which has enabled low rates of interest to be obtained on the Board's stock and temporary borrowings. Without this Government assistance the Board would not have been able to carry out its schemes of development so rapidly and maintain such low tariffs.



Work in progress on the extension of the Sydney (N.S.W.) County Council's Bunnerong power station. Two 50,000-kW turbo-alternators to be supplied with steam at 600 lb. per sq. in. and 825 deg. F. from four 350,000 lb. per hr. pulverised fuel boilers are being erected. (Courtesy, " Electrical Engineer & Merchandise," Australia)

Soviet Union.—MOSCOW CENTRAL HEATING STATIONS.—The heating of industrial enterprises and dwelling houses from central thermo-electric stations is gradually being extended in Moscow and it is estimated that about 350,000 tons of fuel a year are economised by this system. The Frunze thermo-electric station in Moscow is being extended and a steam conduit 1½ km. in length was put into operation last month to supply a number of industrial concerns. In the whole of the U.S.S.R. there were altogether eighty-four thermo-electric stations in 1937, in which year their combined output was some 21½ million megacalories.

TRACTION

Canada. — RAILWAY ELECTRIFICATION. — A three-year programme of the Canadian National Railways includes the electrification of tracks between the central station, Turcot and St. Lambert, states *Reuter's Trade Service.*

Eire.—RAILWAY ELECTRIFICATION SUGGESTED.—A suggestion that the Eire railway system should be electrified was made by Senator J. J. Parkinson at the annual meeting of the Federation of Irish Industries which was held during last week. He said that the whole railway system of the country could be run on 40,000,000 kWh if it were electrified and for the £400,000 that was paid to Britain for coal to run the railways 70,000,000 kWh could be generated.

Germany.—ELECTRIC LOCOMOTIVES.—To develop electric traction the Reich railway authorities are having a few experimental electric locomotives built with a maximum speed of 112 m.p.h. The first was received from the Hennigsdorf works in December. It is 17 m. long and has a normal rating of 5,000 HP with a maximum of 8,000 HP. It is claimed that the locomotive is able to haul a truck load of 360 tons and attain the maximum speed in 4½ minutes.

Italy.—TROLLEY-BUS SERVICES.—The buses running between Milan and Lodi are to be replaced by trolley-buses in 1940. Further trolley-bus services are under construction between Milan and Rogoredo, and between Milan (Stazione Centrale), Greco and Sesto San Giovanni, and another is being developed on the outskirts of Milan.

ELECTRIFICATION PROBLEMS.—The length of the State electrified railways is now about 3,000 miles and this year 187 miles

will be added, including the Milan-Voghera and the Ancona-Rome lines, and the investigations for the electrification of the Milan-Domodossola, Cervignano-Bologna and Trento-Verona-Bologna lines will be finished. With the completion of the Milan-Domodossola line, the whole Simplon line will be electrified from Switzerland to the south of Italy. The Milan-Gallarate section of this line is operated at 3,000 V DC, whereas the electrified railway from Milan to Porto Ceresio, which is operated on the DC third-rail system. The relative advantages of changing the system on the section and of building a new railway from Milan to Gallarate for the Domodossola line are under consideration. Similar differences in system are also hindering the traction on the Milan-Genoa line and on the Genoa-Leghorn-Rome line since while the Milan-Voghera and the Rome-Leghorn lines are to be electrified at 3,000 V DC, on the Voghera-Genoa and the Leghorn-Genoa-Modane lines AC is in use. With the ordinary trains this involves only a change of locomotive, but with the streamlined trains on the Rome-Genoa line, the traction machinery of which is fitted in one of the coaches, passengers and baggage have to be transferred at Viareggio; on the Genoa-Milan line this difficulty is overcome by the employment of a Diesel-engined streamlined train throughout the journey.

Switzerland.—NEW 12,000 H.P. LOCOMOTIVE FOR THE FEDERAL RAILWAYS.—In 1931 the Swiss Federal Railways put into service an 8,800 HP locomotive which was, at the time, the most powerful built on the Continent. Last year a further single-phase locomotive of similar type was ordered from the Oerlikon Co. and the Swiss Locomotive and Machine Works. In this case, however, the one-hour output has been raised to about 12,000 HP. The number of axles is the same as before (14), but the overall length has been increased to 34 m. The total weight in working order is about 244 tons and the total adhesive weight about 160 tons. The new locomotive can haul express trains of 600 tons, exclusive of the weight of locomotive, on the gradients of 1 in 38.5 of the St. Gotthard line at a speed of about 40 m.p.h. The one-hour rating corresponds to a tractive effort of about 88,000 lb. at a speed of 47 m.p.h. To obtain a tractive effort at starting of 110,000 lb. it is necessary to raise the adhesive weight of all driving axles from 160 to about 172 tons. This can be done in a very simple way by taking weight off the middle free axles by means of a compressed air weight-reducer.

TROLLEY-BUSES IN LAUSANNE.—Following an experimental service the Société des Tramways Lausannais has decided to replace the trams on six routes by trolley-buses, states *Reuter's Trade Service*. After the tests it was decided, in the light of experience gained, that the trolley-buses should have seating accommodation for twenty-three and standing space for thirty people. The compound motors are to be of 87 HP at 960 RPM (650 V). The average speed will be 16 km. per hr. with a maximum of 45 km per hr. The electrical equipment has been ordered from the Brown-Boveri Co., of Baden.

TOURIST LINE ELECTRIFICATION.—It has been decided to electrify the celebrated metre-gauge Brunig line connecting Lucerne and Interlaken, and conversion is to begin during 1939. The cost is estimated at £635,000.

United States.—PASSENGER TRANSPORT IN NEW YORK.—An analysis of tram and railway traffic in New York has been conducted by *Mass Transportation*. It was found that 80½ per cent. of the people used electric railways and trams and 19½ per cent. buses. Electric railways carried 1,975,600,000 passengers in 1936 and 1,964,900,000 in 1937; electric street cars carried 580,500,000 and 554,600,000 respectively, the figures for buses being 545,000,000 and 609,100,000. It is interesting to note that although the average speed of street cars was 11.2 m.p.h. that of "rapid transit" railways was only 17.2 m.p.h. There is 700 miles of street car track and 776 miles of railway track.

West Hartlepool.—TROLLEY-BUS EQUIPMENT.—The Town Council is seeking sanction to borrow £1,180 for the reconstruction of overhead trolley-vehicle equipment in Coronation Street.

Selected Station Extensions

DURING 1938 the Central Electricity Board arranged with authorised undertakings to install thirty-four turbo-alternators of a gross capacity of 843,500 kW and sixty boilers with an evaporative duty of 10,834,000 lb. per hour. Allowing for sets that were replaced or reconstructed and deducting auxiliary units, the net increase in generating plant works out at 812,750 kW for twenty-seven new main units. Our corresponding list for 1937 gives seventeen main sets with an aggregate output of approximately 635,000 kW and thirty-nine boilers evaporating 7,000,000 lb. per hr. No cooling towers were provided for in 1938. The 120,000-kW station for Ipswich, preliminary proposals in regard to which were referred to in the ELECTRICAL REVIEW of May 20th and 27th last, with an initial installation of two 30,000-kW sets, is not included in the list.

Twenty-one of the new turbo-alternators are of 30,000 kW and above. All those of 30,000 kW will run at 3,000 RPM, as will also the 60,000-kW group for Brimsdown A, while the 50,000-kW unit for Hams Hall and the 60,000-kW unit for Littlebrook (where the first 30,000-kW set should be running in the autumn) will be designed for 1,500 RPM. Four of the projected boilers will be rated at 300,000 lb. per hour and above.

Steam temperatures of 800 deg. and over will obtain in twenty stations out of the twenty-nine listed. In ten stations pressures will be from 600 to 675 lb. per sq. in. and in two of these (Brighton and Little Barford) the temperature will exceed 850 deg. F., as it will in two of the three stations with pressures of more than 1,200 lb. per sq. in., Willesden and Brimsdown A. At Littlebrook, however, the temperature will be 825 deg. for a pressure of 1,233 lb. per sq. in., so presumably inter-stage steam reheating is intended there. Eleven of the alternators are being wound for 33 kV, including two for the Brimsdown A 60,000-kW group.

While in many of the stations the steam conditions proposed are on a par with those obtaining now, in some—notably Willesden—they will be raised for the extension. Information is not yet available as to the type of boiler to be used there, but extensions at Brimsdown A are to be with forced-circulation boilers. Seventeen of the twenty-seven stations to be extended returned for 1937 thermal efficiencies based on kWh sent out of less than 20 per cent., thus illustrating the importance of site conditions.

NEW GENERATING PLANT IN THE C.E.B. PROGRAMME FOR 1938

Grid Area and Station.	Owners.	Turbo-alternators, kW.	Boilers, lb. per hour.	Steam Conditions.* lb./per sq. in.	Steam Conditions.* Temperature, deg. F.	Alternator, kV.
C. Scotland.						
Portobello... ...	Edinburgh Corp. ...	1—15,000†	—	290	700	6.6
N.E. England.						
Dunston A ...	North Eastern Co. ...	1—15,000‡	—	190	600	5.75
N.W. England and N. Wales.						
Percival Lane ...	Mersey Power Co. ...	2—30,000	3—187,500	400	800	11.0
Bolton	Bolton Corp.	2—30,000 2— 1,250‖	5—150,000	400	800	6.6
Mid-East England.						
Kirkstall	Leeds Corp.	1—30,000	2—250,000	450	720	11.0
York	York Corp.	1—20,000	2—100,000	400	750	11.0
Halifax	Halifax Corp. ...	1—20,000	2—110,000	350	750	6.6
Hull	Hull Corp.	—	1—187,500	400§	825§	—
Prince of Wales ...	Rotherham Corp. ...	1—25,000	2—200,000	600	850	11.0
Central England.						
Hams Hall ...	Birmingham Corp. ...	1—50,000 1— 3,500‖	1—320,000	650	825	33.0
Stourport	S.W. and S. Power Co.	1—30,000	2—182,000	625	825	33.0
Hardingstone ...	Northampton Co. ...	1—30,000	1—150,000	400	800	33.0
Coventry	Coventry Corp. ...	1—30,000 1— 750‖	2—150,000	300	700	33.0
Wolverhampton ...	West Midlands J.E.A.	1—30,000	4—120,000	375	750	6.6
Spondon	Derby and Notts Co.	1—30,000	2—200,000	350	700	11.0
S.E. & E. England.						
Willesden	North-Met. Co. ...	2—30,000 2— 3,000‖	5—150,000	1,300	950	33.0
Brimsdown A ...	North-Met. Co. ...	1—60,000 group	2—250,000	1,900	930	33.0
Little Barford ...	Beds, Camb. and Hunts Co.	2—30,000	3—300,000	650	900	11.0
Woolwich ...	Woolwich Corpn. ...	1—30,000	2—165,000	400	800	22.0
Barking	County of London Co.	—	4—256,000	625§	825§	—
Fulham	Fulham Corpn. ...	—	2—270,000	650§	850§	—
Brighton	Brighton Corpn. ...	—	2—215,000	675§	875§	—
Croydon	Croydon Corpn. ...	1— 7,000**	—	500	800	6.6
Littlebrook ...	Kent Power Co. ...	1—60,000	2—250,000	1,235	825	15.0
S.W. England and S. Wales.						
Upper Boat ...	South Wales Co. ...	1—30,000	2—182,000	625	835	33.0
Cardiff	Cardiff Corpn. ...	1—30,000	2—150,000	600	850	33.0
Portsmouth ...	Portsmouth Corpn. ...	1—30,000	2—150,000	600	800	33.0
Plymouth ...	Plymouth Corpn. ...	1—20,000	2—100,000	400	800	6.6
Portishead ...	Bristol Corpn. ...	—	1—162,500	325§	825§	—

Speed of turbo-alternators, 3,000 RPM except at Portobello, Hams Hall and Littlebrook where it is 1,500 RPM.

† Replacing 1—12,500 kW set. ** Replacing 1—5,000 kW set. ‡ 1—13,250 kW, 40-cycle set reconstructed. * At turbine stop valve. § At boiler stop valve. ‖ Auxiliary sets.

FINANCIAL SECTION

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares.

New Companies Registered

Ducati (England), Ltd.—Private company. Registered January 19th. Capital, £1,000. Objects: To carry on the business of electricians, electrical, mechanical and wireless engineers and manufacturers of and dealers in electrical appliances and apparatus, &c. Subscribers: P. Cowling, 12, Upsdell Avenue, N.13, and two others. Solicitors: Gilbert Samuel & Co., 6, Great Winchester Street, E.C.2.

H. A. Turnpenny & Co. (Belfast), Ltd.—Private company. Registered in Belfast January 13th. Capital, £2,000. Objects: To acquire the business of an electrical engineer and battery agent carried on by Marguerita Jeffrey at 4, Linenhall Street West, Belfast, as "H. A. Turnpenny & Co." Mrs. M. Jeffrey, Avonlea, Diamond Gardens, Finaghy, Belfast, is the first director. Registered office: 4, Linenhall Street West, Belfast.

George Martin's Electrical & Radio, Ltd.—Private company. Registered January 19th. Capital, £500. Objects: To carry on the business of merchants, agents, and manufacturers of and dealers in electrical appliances, radio and television apparatus, refrigerators, &c. Directors: G. H. Martin and Mrs. K. H. Martin, both of 14, North Street, Guildford. Registered office: 14, North Street, Guildford.

Electric Automatic Controllers, Ltd.—Private company. Registered January 28th. Capital, £1,000. Objects: To carry on the business of exporters of electric automatic controls for electric vehicles, and to grant licences for the manufacture and sale of such controls in the British Empire and elsewhere. The first directors are G. Wolff and J. Sherwood. Solicitors: Bartlett & Gluckstein, 199, Piccadilly, W.1.

Locke and Soares, Ltd.—Private company. Registered January 28th. Capital, £10,000. Objects: To adopt an agreement with A. H. Locke for the acquisition of the business of an electrical engineer and contractor, and supplier of and dealer in electrical appliances and accessories carried on by him at 6/10, New Cavendish Street, W.1, as Locke and Soares. Subscribers: F. J. Wheeler and P. Richards, both of 24, Coleman Street, E.C.2. Secretary: P. Richards. Registered office: 24, Coleman Street, E.C.2.

T. & S. (Engineers' Supplies), Ltd.—Private company. Registered January 27th. Capital, £100. Objects: To carry on the business of general, electrical and mechanical engineers and contractors, toolmakers, iron, steel and metal merchants. &c. The directors are: R. R. A. Smith, Ewen Manor, Cirencester, Glos.; and G. T. Turton, 9, Dormers Wells, Southall, Mdx. Registered office: 36, North Road, Southall, Mdx.

W. Rowe (Cardiff), Ltd.—Private company. Registered January 28th. Capital, £1,000. Objects: To acquire the business of a smith and general engineer and electrical engineer heretofore carried on by Percy W. Rowe at Windsor Road, Cardiff, and at 25, Beulah Road, Rhiwbina. Directors: P. W. Rowe, 25, Beulah Road, Rhiwbina, Glam; J. B. Green and C. W. Green, both of 147, Mackintosh Place, Cariff. Solicitors: Eustace Davies & Buck, 27, Park Place, Cardiff.

Electromex, Ltd.—Private company. Registered January 27th. Capital, £1,000. Objects: To carry on business as mechanical, electrical and general engineers and manufacturers, tool makers, plastic moulders, &c. Directors: J. I. Martin, 52, Clarendon Drive, Putney, S.W.15 (permanent managing director and chairman), and four others. Secretary: E. V. Hawkins. Registered office: 149, Cheapside, E.C.2.

W. H. Tant & Co., Ltd.—Private company. Registered January 25th. Capital, £5,000. Objects: To carry on the business of manufacturers of, and workers in, mouldings in bakelite, acetate, ebonite, erinoid, vulcanite, fibre and similar materials, toolmakers, engineers, &c. Directors: Wm. H. Tant (permanent director and chairman), 8, Water Orton Road, Castle Bromwich, near Birmingham, and two others. Solicitors: James Ore, 33, Temple Row, Birmingham.

Landore Zinc, Ltd.—Private company. Registered January 23rd. Capital, £2,000. Objects: To carry on the business of extracting, reducing and precipitating by hydro-metallurgical, metallurgical, hydro-electric or other processes, any metals or metallic substances, ferrous or non-ferrous, &c. Directors: I. T. Rees, "Palleg," Mansel Road, Bonymaen, Swansea, and C. Jones, 60, Manselton Road, Swansea. Solicitor: W. C. Oliver, Swansea.

A. Perton Signs, Ltd.—Private company. Registered January 24th. Capital, £2,000. Objects: To carry on the business of inventors, designers and manufacturers of and dealers in signs of all kinds, &c. Subscribers: A. E. Perton and Mrs. F. E. Perton, both of 3, Beaconsfield Terrace Road, Kensington, W.14. Secretary: A. D. Wells, 48, Uxbridge Road, W.5.

Kine Supplies (Birmingham), Ltd.—Private company. Registered January 26th. Capital, £100. Objects: To carry on the business of wholesale and retail suppliers, distributors, renters of, agents for and dealers in all electrical and other equipment, accessories, stores and other requirements for the carrying on of cinematograph entertainments, &c. Directors: R. F. Naylor, 583, Reddings Lane, Hall Green, Birmingham, 28, and C. N. Cooke, 21, Carisbrooke Road, Edgbaston, Birmingham.

Ron Scarisbrick, Ltd.—Private company. Registered January 26th. Capital, £200. Objects: To carry on the business of manufacturers of radio and television receivers, accessories and equipment, &c. The permanent directors are: R. F. Scarisbrick, "Ronora," Castle Drive, Whitby, Ches, and J. Taylor, 59, Staplands Road, Broad Green, Liverpool. Registered office: 76-8, Station Road, Ellesmere Port, Ches.

Centrivo, Ltd.—Private company. Registered January 23rd. Capital, £1,500. Objects: To acquire the business of a heating engineer and specialist carried on by Geo. Taylor, at 176, Windsor House, Victoria Street, S.W., and to carry on the business of electricians, electrical and mechanical engineers, &c. Directors: G. Taylor (permanent governing director), 74, Lancaster Gate, W.2, and Rev. R. F. Camenisch, 36, Ullet Road, Liverpool. Secretary: R. A. Bellamy. Registered office: 176, Windsor House, Victoria Street, S.W.1.

Returns of Electrical Companies

Statements of Capital

Insulators, Ltd.—Capital, £15,000 in £1 shares. Return dated July 7th (filed December 16th), 1938. 13,650 shares taken up. £13,650 paid. Mortgages and charges: £10,000.

Tubes, Ltd.—Capital, £215,000 in £1 shares. Return dated November 14th, 1938. All shares taken up. £107,584 paid (£1 on 32,859 shares and 10s. on 49,450 shares), £107,416 considered as paid (£1 on 82,691 shares and 10s. on 49,450 shares). Mortgages and charges nil.

Glynceiriog Electricity Supply Co., Ltd.—Capital, £1,500 in £1 shares. Return dated November 14th, 1938. 1,000 shares taken up. £1,000 considered as paid. Mortgages and charges nil.

B. French, Ltd.—Capital, £5,000 in £1 shares. Return dated November 14th, 1938. 4,750 shares taken up. £4,750 paid. Mortgages and charges nil.

Pollard & Smith, Ltd.—Capital, £2,000 in £1 shares. Return dated November 12th, 1938. All shares taken up. £2,000 paid. Mortgages and charges nil.

Philips Lamps, Ltd.—Capital, £100,000 in 100,000 shares and 100 "B" shares of £1. Return dated November 16th. All shares taken up. £100,100 paid. Mortgages and charges nil.

Electroservice, Ltd.—Capital, £100 in £1 shares. Return dated November 17th. All shares taken up. £100 paid. Mortgages and charges, nil.

Mosbrough Electric Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated November 17th. 3,275 shares taken up. £3,275 paid. Mortgages and charges, nil.

Magna Wire & Cable Co., Ltd.—Capital, £11,000 in 10,000 preference shares of £1 and 20,000 ordinary shares of 1s. Return dated November 18th. 2,027 preference and 11,500 ordinary shares taken up. £2,027 paid on the preference shares. £575 considered as paid on the ordinary shares. Mortgages and charges, nil.

Austinlite, Ltd.—Capital, £6,000 in £1 shares. Return dated November 16th. All shares taken up. £6,000 paid. Mortgages and charges nil.

Key & Dawson, Ltd.—Capital, £1,000 in £1 shares. Return dated November 15th. 290 shares taken up. £290 paid. Mortgages and charges nil.

Mortgages and Charges

Westool, Ltd.—Mortgage dated March 9th, 1923, charged on Westool Works, 116, Putney Bridge Road, S.W.15 (property acquired June 8th, 1923), on which £4,500 was owing on November 1st, 1929. (Registered January 18th, 1939, pursuant to Section 91 of the Companies Act, 1929.) Mortgagee: Blanche E. Robinson, 39, Hamilton Terrace, N.W.

J. S. Peress, Ltd.—Second debenture dated January 10th, 1939, to secure £1,500, charged on the company's undertaking and property, present and future, including uncalled capital (subject to mortgage dated June 22nd, 1938). Holders: W. Wolsey and J. S. Peress, both of 144, Theobalds Road, London, W.C.1.

Burgess Hill Electricity, Ltd. (formerly Burgess Hill and District Electric Supply Co., Ltd.).—Satisfaction in full on January 31st, 1934, of debenture dated October 7th, 1930, and registered October 17th, 1930. (Notice filed January 18th, 1939.) According to the register of mortgages, the debenture registered October 17th, 1930, originally secured all moneys due to bank.

Ebonestos Industries, Ltd.—Satisfaction in full on December 23rd, 1938, of debentures authorised January 11th, 1921, and registered January 14th, 1921, securing £20,000.

Taylor Reid & Co., Ltd.—Particulars filed of £500 debentures, authorised January 11th, 1939, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £200.

Receivers Appointed

Universal Lighting Co., Ltd.—H. Rainsbury, F.S.A.A., of 133/139, Finsbury Pavement, E.C., was appointed receiver on January 16th, 1939, under powers contained in debentures dated February 10th and May 5th, 1938.

Long Range Radio, Ltd.—H. Finck, of 69, Basinghall Street, E.C.2, was appointed receiver and manager on January 19th, 1939, under powers contained in debenture dated December 31st, 1936.

Increases of Capital

R. B. Pullin & Co., Ltd.—The nominal capital has been increased by the addition of £30,000 beyond the registered capital of £70,000. The additional capital is divided into 300,000 ordinary shares of 2s.

Electric Supplies & Repairs, Ltd.—The nominal capital has been increased by the addition of £1,500 in £1 shares, beyond the registered capital of £1,000.

Reports and Dividends

The Singapore Traction Co., Ltd., reports a profit for the year ended September 30th, after charging debenture interest and London expenses, of £55,580, as compared with £65,926 in the preceding year, to which is added £3,170 brought in, making £58,750. After providing for depreciation and renewals, &c., there is a balance of £9,211, out of which it is proposed to pay a dividend for the year of 5 per cent. on the ordinary stock (against 7½ per cent.). The balance carried forward is £3,197. The report states that a strike caused a suspension of the trolley-bus and omnibus services from July 7th to August 21st, and in consequence the number of vehicle-miles decreased by 11.13 per cent., the number of passengers carried by 9.47 per cent., passenger receipts by 8.43 per cent., and operating profit by £9,932, as compared with the previous year.

R. B. Pullin & Co.—The whole of the 300,000 ordinary 2s. shares created at the recent meeting has been acquired by Electric and General Industrial Trusts at 4s. each. By the Trusts' agreement with the company the shares are being offered at the same price to shareholders. Provisional letters of acceptance have been posted to shareholders entitling them to take up three new shares for every seven shares held.

International Combustion, Ltd., reports a net profit for the year ended September 30th, before providing for taxation, of £231,933, an increase of £54,278 as compared with the previous year, to which is added £17,878 brought in. Reserve receives £50,000 and income tax and N.D.C. £55,000, and it is proposed to pay a final ordinary dividend of 12½ per cent., again making 20 per cent. for the year, but the cash bonus is raised by 2½ per cent. to 12½ per cent. The balance carried forward is £21,510. Meeting: February 9th.

The Power Securities Corporation, Ltd., reports net profits of £95,298 for the year ended December 31st, as compared with £104,811 for 1937. The ordinary dividend for the year is maintained at 7 per cent.

J. & E. Hall, Ltd., report net profits for the year ended September 30th of £69,280, as compared with £47,388 in the preceding year. The ordinary dividend is raised from 7 to 10 per cent., and the balance carried forward is £35,901 (against £30,621 brought in).

The Rheostatic Co., Ltd., reports a trading profit for the year ended September 30th of £21,453, plus dividends and interest, £80, as compared with £21,220 in the preceding year, and a net profit of £11,346 (against £16,417), to which is added £1,506 brought in. The final ordinary dividend is 4 per cent., making 8 per cent. for the year (against 12 per cent.), and £1,579 is carried forward. Meeting: February 6th at Slough.

The Shawinigan Water & Power Co. reports gross earnings for 1938 of $14,388,000 (£2,877,000) as compared with $14,769,143 (£2,954,000) for 1937, and net earnings of $4,248,492 (£849,000), as against $4,585,684 (£917,000). The output for the year was 5,256.5 million kWh, a decrease of 8 per cent. as compared with 1937. During the year new contracts and extensions to existing contracts were entered into amounting to over 8,000 HP and a new industry at Cap de la Madeleine, known as International Foils, has contracted to take 3,000 HP. The output of the generating stations (including hydro-electric), decreased by 27.1 million kWh to 4,179.2 million kWh, and power purchased under contract by 35.9 million kWh to 663.3 million kWh.

Laurence, Scott & Electromotors, Ltd.—An extraordinary meeting will be held at Norwich on February 22nd for the purpose of adopting up-to-date articles.

The Mersey Railway Co. is paying a dividend of £1 15s. per cent., less tax, on the consolidated ordinary stock (against 17s. 6d. per cent. for 1937).

The Electrical & Industrial Investment Co., Ltd., is maintaining its dividend for the year at 10 per cent.

Stocks and Shares

TUESDAY EVENING.

THE relief experienced at the removal of war apprehensions brought about a dramatic change in Stock Exchange markets. Monday night's speech of Herr Hitler had been awaited with misgivings, not to say anxiety. The obvious desire on the part of the Fuehrer to obviate war at the present juncture was hailed in New York, and immediately afterwards in London, as a foundation for assurance that the war cloud has passed, at any rate, for some time to come. The effect was instantaneous. Prices went ahead in remarkable fashion. Stock Exchange brokers were besieged with orders to buy; by far the majority of these were at prices which had ruled on the previous day.

Optimism combined with these orders to give the Stock Exchange a complete change of complexion, with the result that, after being distinctly flat at the end of last week, the picture changed over to hopefulness and activity. When investor becomes more accustomed to the conviction that the threat of war is a thing of the future, it is assumed that prices will further improve upon the substantial gains which they secured early this week.

Gilt-edged Declines

For a gilt-edged stock, such as London Passenger Transport "B," to shed 6 points in a week, comes as an unpleasant reminder of the investor's disinclination to buy fixed-interest securities at the present time. The price has dropped to 108½. The 4½ per cent. "A" stock is 2 down, at 106½, and the speculative "C" issue shows a fall of 3, which leaves it at 69; within a point, that is to say, of the lowest level reached last year. Central Electricity stocks are also easier, but the declines are less marked than those in the Transport Board prices. According to one theory which finds favour in the Stock Exchange, investors are exhibiting marked preference for ordinary stocks and shares, turning out some of the former in order to make room for purchases of the latter. The shadow of the next Budget makes inevitable contribution to the arguments put forward in favour of such "swapping" of stocks and shares.

Equipment and Manufacturing

Many of the prices for shares in the manufacturing group were marked down in the depression of last week, and had not been restored to their previous figures when our price lists were made up on Tuesday night. Industrials as a whole went better in the recovery, but unless prices are tested by actual business, their nominal quotations may remain unchanged for two or three days. It is therefore quite possible that the quotations in the accompanying price lists do not represent the extent of the rally, that the falls which are recorded would be found less numerous than they appear to be. The difficulty experienced in selling shares a week ago is matched by almost equal trouble in buying them to-day. Stock Exchange brokers have found themselves armed this week with long lists of orders to buy shares for clients who wanted those shares at the prices that ruled a week ago.

A Week-end's Changes

By the end of last week the average of industrial share prices was down to the lowest level of the critical pre-Munich days. The following table gives some measure of the relief which Monday night's speech brought to various markets:—

Stock or Share.	Lowest 1938.	Friday, Jan. 27th.	Tuesday, Jan. 31st.	Rise.
Cable and Wireless Ord.	34	35½	38½	3
Great Northern Tel.	34	36½	36½	—
American Tel. & Tel.	114	162½	164½	2
B.E.T. Deferred	675	750	825	75
Southern Rly. 5 p.c. Pfd.	48	49	53¼	4¼
T. Tilling	36/6	40/–	43/9	3/9
Brazilian Traction	7½	8¼	8¾	½
Assoc. Elec. Ind.	32/–	36/–	37/–	1/–
General Electric	67/–	71/–	73/6	2/6
Siemens	20/6	21/3	21/3	—
Callenders	78/6	70/–	75/–	5/–
British Aluminium	40/–	49/6	53/9	4/3
Westinghouse Brake	45/–	45/–	48/–	3/–

Cable and Wireless

With the complete year's traffic indices before them, the mathematicians have been busy on estimates of Cable and Wireless earnings and dividends. The task is complicated by the introduction, at various dates, of such measures as the cut in cabling rates and the cancellation of the £250,000 beam rental, and by such imponderables as the income from investments and the level of working costs. Consequently, the conclusion that the operating company's earnings have fallen to about 3 per cent. is a fairly rough guess. One certain factor to be taken into account is the sum of £300,000 set aside last year for the express purpose of levelling up dividends during the transition stage of the new schemes. Prices of the stocks showed renewed weakness until the Hitler speech set the bears buying back their preference and ordinary, with the result that the market became noticeably firmer. Globe ordinary touched 23s. 6d. before rallying to the previous price of 25s. The transatlantic cable stocks improve. Amongst lower-priced descriptions, Canadian Marconis are dull at 4s. 3d.

Dividend Prospects

Public interest lies in the stocks of Cable and Wireless (Holding), whose revenue comes mainly in dividends from the holding of shares in the operating company. Of this holding, £2,600,000 stock was transferred to the Government during the year, so that the revenue will be smaller even though the operating company's dividend is maintained at last year's rate of 3½ per cent. Allowing for a small falling-off in other sources of income, the conclusion is that Cable and Wireless (Holding) should be able to pay the 5¼ per cent. preference dividend without difficulty, leaving a balance of earnings equal to about 3 per cent. on the ordinary stock. Should the former be declared, this would provide a yield of 7 per cent. on the money at the current price, 78½, of the preference stock.

American Reactions

Wall Street was obviously relieved, without being unduly enthusiastic, over the European news. A moderate recovery followed several days of sharply falling prices, the political tension having had the effect of sharpening apprehension over the soundness of the domestic business recovery in the U.S.A. In a generally uneasy frame of mind, the American market has also been inclined to regard with suspicion the extravagancies of the Administration's financial policy. Altogether, there are few signs of a return to the confidently bullish attitude of a few months back. Of late, the steadiest section of the market has been that concerned with electricity supply and other public utility stocks. That these should have been singled out is evidently due to the good electricity output figures and, no less, to the belief that the Administration is relenting of its previously hostile attitude to the utility undertakings.

ELECTRICAL COMPANIES' SHARES

Prices, dividends and yields

Company.	1938. Highest.	1938. Lowest.	Dividend. Previous.	Dividend. Last.	Price Jan. 31.	Rise or Fall.	Yield p.c. £ s. d.
Home Electricity Companies							
Bournemouth and Poole ...	68/3	62/–	15	15	66/3	–⅛	4 11 0
British Power & Light ...	30/9	24/6	6	7	26/6	–6d.	5 5 8
City of London	34/6	28/6	7⅛	7⅛	32/–	—	4 13 9
Clyde Valley	42/6	33/–	8	8	35/9	–6d.	4 9 6
County of London ...	51/9	38/9	10½	10½	43/6	—	4 16 5
Edmundson's :							
7% Pref....	33/3	30/–	7	7	30/–	—	4 13 4
Ord.	40/9	18/9	9	9	24/–	–1/–	—
Elec. Dis. Yorkshire ...	43/6	37/9	9	9	39/6	—	4 11 2
Elec. Fin. and Securities...	51/9	49/–	12½	12½	46/3	—	5 8 3
Elec. Supply Corporation...	55/–	50/–	12	12	48/9	–⅛	4 18 4
Isle of Thanet	21/3	18/6	4	4	20/–	—	4 0 0
Lancs Light and Power ...	35/–	26/–	7½	7½	30/–	–9d.	5 0 0
Llanelly Elec.	23/6	21/–	5½	5½	21/6	—	5 2 4
Lond. Assoc. Electric ...	32/9	28/–	7	7	28/9	–9d.	4 17 4
London Electric	36/3	32/–	7	7	33/–	—	4 4 10
London Power Deb. Red.	108¾	100	5	5	104½	–1½	4 15 6
Metropolitan	51/–	41/–	10	12	46/3	–⅛	5 4 1
Midland Counties	39/9	33/–	8	8	35/–	—	4 11 6
Mid. Elec. Power	41/9	37/–	8	9	38/9	–⅛	4 12 10
Newcastle Elec.	31/9	27/6	7	7	28/9	—	4 17 4
North Eastern Electric :							
Ordinary...	34/–	25/–	7	7	30/–	—	4 13 4
7% Pref....	34/–	30/–	7	7	30/–	–⅛	4 13 4
Northampton	47/6	43/9	10	10	45/3	–⅛	4 9 0
Notting Hill 6% Pref. (£10)	14½	13½	6	6	13½	—	4 12 4
North Met. Elec. :							
Ordinary...	49/–	43/–	10	10	43/3	–6d.	4 12 5
6% Pref....	30/6	28/3	6	6	27/6	–1/–	4 7 3
Richmond Elec.	30/6	28/–	7	7	28/9	—	4 17 5
Scottish Power	38/9	32/–	8	8	35/–	—	4 11 6
Southern Areas	22/9	18/6	4½	5	20/–	–⅛	5 0 0
South London	32/6	31/–	7	7	31/6	—	4 9 0
West Devon	23/3	21/3	5	5	1½	—	4 9 0
West Glos.	19/–	16/9	2	2	20/–	—	2 0 0
Yorkshire Elec.	42/–	36/9	8	8	36/6	–6d.	4 7 6
Overseas Electricity Companies							
Atlas Elec.	4/6	2/6	Nil	Nil	2/6	—	—
Calcutta Elec.	44/3	36/3	12*	10*	38/9	—	5 3 3
Cawnpore Elec.	40/–	35/–	10	10	33/–	—	6 1 3
East African Power ...	28/3	22/6	7	7	23/–	–1/–	6 1 9
Jerusalem Elec.	26/9	23/3	5	6	23/6	–6	5 2 2
Kalgoorlie (10/–)	12/–	9/6	7½	7½	10/3	—	7 6 4
Madras	34/6	28/9	8*	8*	30/–	—	5 6 8
Montreal Power	31⅞	26⅞	1½	1½	32½	—	—
Palestine Elec. "A" ...	31/9	27/–	7½*	7½*	26/3	–⅛	5 14 4
Perak Hydro-electric ...	25/3	17/–	7	6	16/3	–⅛	7 7 8
Shawinigan Power ...	23½	16½	65cts.	85cts.	22½	+½	—
Tokyo Elec. 6%	65¼	39	6	6	50⅛	–3	11 17 8
Victoria Falls Power ...	76/3	55/–	12	13½	65/–	—	4 3 1
Whitehall Investments Pref.	22/3	15/–	7½	7½	16/3	—	9 4 8
Public Boards							
Central Electricity :							
1950–70	115¾	97	5	5	110¼	—	4 10 6
1955–75	118¼	100	5	5	113⅜	—	4 8 1
1951–73	111	95	4½	4½	105	–1½	4 5 9
1963–93	101	85	3½	3½	94½	—	3 14 1
London Elec. Trans. Gtd.	93½	88	2½	2½	86	–1½	2 17 10
London & Home Counties,							
1955–75	112¾	97½	4½	4½	107	—	4 4 1
Lond. Passenger Transport :							
A	119½	104¾	4½	4½	106½	–2	4 4 6
B	122¾	105	5	5	108½	–6	4 12 4
C	84	68	4¼	4	69	–3	5 16 0
West Midlands Joint Elec.,							
1948–68	115½	102½	5	5	112	—	4 9 3
Telegraph and Telephone							
American Tel. & Tel. ...	160	114	9	9	164½	+2	5 9 9
Anglo-Am. Tel. :							
Pref.	115½	100½	6	6	98½	—	6 1 10
Def.	28	23	1½	1½	23	—	6 10 8
Anglo-Portuguese	23/6	19/3	8	8	21/3	—	7 10 7
Cable & Wireless :							
5½% Pref.	104	76½	4½	5½	78½	—	7 0 1
Ord.	67¾	34	—	4	38½	+1	10 7 10
Income	102½	99	—	—	100	—	4 0 0
Canadian Marconi $1 ...	6/6	3/9	—	Nil	4/3	–6d.	—
Globe Tel. & Tel. :							
Ord.	32/6	26/3	5½*	7½*	25/–	—	6 0 0
Pref.	27/6	23/9	6	6	26/3	—	4 11 5
Great Northern Tel. (£10)...	42½	34	20	20	36½	—	5 9 7
Inter. Tel. & Tel.	12½	5⅞	Nil	Nil	9½	+½	—
Marconi-Marine	30/6	21/6	10	7½	23/9	—	6 6 4
Oriental Telephone Ord. ...	59/3	2½	12*	12*	2⅝	—	4 11 3
Radio Corpn.	9½	4⅜	8	6	7⅞	+½	—
Telephone Props	13/9	11/3	5	6	13/9	—	8 14 6
Telephone Rentals (5/–) ...	10/–	7/6	5	6	9/–	—	3 6 8
Western Union	34½	17	2⅜	—	23½	+½	—
Traction and Transport							
Anglo-Arg. Trams :							
First Pref.	11/–	2/6	Nil	Nil	3/9	–⅛	—
4% Inc.	31	8	Nil	Nil	8	—	—
British Electric Traction :							
Def. Ord.	1060	675	5	6	825	–25	—
Pref. Ord.	175	150	8	8	160	—	5 0 0
Bristol Trams	45/–	34/3	5	8	38/3	–2/–	4 3 7
Brazil Traction	14½	7⅞	$1	—	8¾	+¾	—
Calcutta Trams	26/9	21/6	8	8	24/6	—	6 10 8
Cape Elec. Trams	18/6	15/6	5	6	17/6	—	6 17 2
Lancs Transport	35/3	29/3	10	10	34/6	–1/9	5 16 0
Mexican Light :							
1st Bonds	39	16½	5	5	25	—	—
Rio 5% Bonds	91	47	5	5	55	—	9 1 10
Southern Rly :							
5% Prefd.	87	48	5	—	53½	—	—
5% Pref....	116	83	5	5	83½	—	5 15 6
T. Tilling	60/–	36/6	10	10	2⅞	+⅛	4 11 4
Tilling & B.A.	57/–	46/–	10	9*	51/3	+⅛	3 10 2
West Riding	46/3	30/6	10	10	32/6	—	—
Equipment and Manufacturing							
Aron Electricity Ord. ...	40/3	31/–	15	15	1½	—	10 0 0
Assoc. Elec. :							
Ord.	45/3	32/–	10	10	37/–	+6d.	5 8 1
Pref.	38/9	35/6	8	8	36/–	—	4 9 0
Automatic Telephone & El.	43/–	35/–	5	10	40/–	–⅛	5 0 0
Babcock & Wilcox ...	44/–	32/6	10	10	38/9	+⅛	5 18 4
British Aluminium Ord. ...	54/–	40/–	10	12½	53/9	+½	4 13 6
British Insulated Ord. ...	95/9	77/–	20	20	4½	—	4 17 1
British Thermostat (5/–) ...	16/–	9/–	17½	18½	12/6	–⅛	7 8 0
British Vacuum Cleaner (5/-)	35/9	27/–	40	40	22/–	—	—
Brush Ord.	5/6	4/9	Nil	Nil	4/9	–3d.	—
Callender's	5⅛	78/6	20	20	75/–	–¼	5 6 8
Chloride Elec. Storage ...	77/9	61/–	15	20	75/–	–¼	5 6 8
Consolidated Signal ...	116/–	75/–	30	36½	4½	–½	8 11 8
Crabtree (10/–)	29/–	22/–	17½	17½	22/6	–⅛	7 15 7
Crompton Parkinson :							
Ord. (5/–)	32/3	18/9	12½	15	16/9	+6d.	—
E. K. Cole (5/–)	8/9	4/6	5	10	5/–	–6d.	10 0 0
Elec. & Musical Industries							
(10/–)	16/3	9/–	10	5	10/3	+6d.	4 19 0
Electric Construction ...	36/–	31/–	10	12½	32/6	—	7 13 10
Enfield Cable Ord. ...	5⅞	46/–	25	25	2⅞	—	—
Electrical Switchgear (10/–)	27/–	22/6	16	16	26/3	—	6 2 0
English Electric	33/–	24/6	Nil	10	32/6	—	6 3 1
Ensign Lamps (5/–) ...	14/3	11/3	—	25	14/–	—	8 18 6
Ericsson Tel. (5/–) ...	2⅜	31/–	25*	25*	36/3	–⅛	3 9 0
Ever Ready (5/–)	26/3	16/6	45	35	20/6	—	8 10 8
Falk Stadelmann	34/3	27/–	10	10	27/6	—	7 5 6
Ferranti Pref.	27/6	25/–	7	7	25/–	—	5 12 0
G.E.C. :							
Pref.	34/–	31/3	6½	6½	31/3	—	4 3 2
Ord.	79/3	67/–	17½	20	73/6	—	5 8 8
Greenwood & Batley ...	27/6	19/–	7	15	26/3	+⅛	11 8 2
Hall Telephone (10/–) ...	24/6	18/3	5	15	20/–	—	7 10 0
Henley's (5/–)	21/–	16/–	15	20	18/9	–9d.	5 6 7
4½% Pref.	23/–	22/–	4½	4½	22/6	—	4 0 0
Hopkinsons	40/–	32/6	10	12½	37/6	+6d.	6 13 0
India-Rubber Pref. ...	21/9	20/3	5½	5½	21/3	—	5 3 6
Intl. Combustion	5/8	4½	30	32½	5½	–¼	6 7 0
Ismay Industries (5/–) ...	6/9	1/–	6	6	1/–	—	—
J. Lucas	57/9	47/6	15	15	53/9	–½	5 11 6
Johnson & Phillips ...	43/9	32/6	10	12½	32/6	–½	7 14 0
Lancashire Dynamo ...	72/3	53/–	20	25	62/6	–½	8 0 4
Laurence Scott (5/–) ...	12/–	9/–	7	15	10/6	–1/6	7 2 10
London Elec. Wire ...	35/–	28/3	12	7½	30/–	—	5 0 0
Mather & Platt	49/–	41/3	12	13½	45/–	–1/3	6 0 0
Metropolitan Elec. Cable Pf.	22/–	21/–	5½	5½	21/3	—	5 3 6
Murex	93/9	66/3	20	20	72/6	+½	5 10 5
Pye Deferred (5/–) ...	12/–	8/–	5	25	8/	–1/–	15 12 6
Revo (10/–)	36/3	30/–	12	17½	33/9	—	5 3 7
Reyrolle	62/6	49/–	12½	12½	53/9	—	4 13 0
Siemens Ord.	31/–	20/6	7½	7½	21/3	—	6 13 4
Strand Elec. (5/–) ...	6/–	4/–	5	10	5/–	—	10 0 0
S. Smith (1/–)	9/9	6/3	37½	50	6/3	–⅛	8 0 0
Switchgear & Cowan (5/–)	19/6	12/6	20	20	15/–	—	6 13 4
Telegraph Condenser (10/–)	18/9	12/–	5	5	10/–	—	5 0 0
Telegraph Construction ...	2½	36/–	7½	10	2¼	—	4 14 1
Telephone Mfg. (5/–) ...	9/9	7/–	9	9	8/6	—	5 6 0
Tube Investments... ...	89/6	70/–	23¾	23¾	85/–	—	5 12 0
Vactric (5/–)	9/9	4/6	10	4	3/3	—	6 3 2
Vickers (10/–)	27/–	17/6	10	10	22/–	+1/9	4 11 0
Westinghouse Brake ...	63/9	45/–	17½	17½	48/–	—	7 6 0
Walsall Conduits (4/–) ...	26/–	22/6	—	55	25/–	–9d.	8 16 0
West, Allen (5/–)	6/6	4/6	—	7½	6/–	–3d.	6 5 0

* Dividends are paid free of Income Tax.

NEW PATENTS

Electrical specifications recently published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1937

8978. "Electrical production of musical tones by electrostatic means." A. H. Midgley and A. M. Midgley. March 30th, 1937. (Cognate application 31847/37.) (498128.)

12105. "Electrical musical instruments." A. H. Midgley and A. M. Midgley. April 28th, 1937. (498130.)

14601. "Method of manufacturing mercury displacement relays." A. F. Burgess. (Adlake Co.) May 26th, 1937. (498133.)

14800. "Mosaic electrode structures for use in cathode-ray apparatus for television and similar purposes." G. S. P. Freeman. May 28th, 1937. (498134.)

15219. "Railway signalling systems." Standard Telephones & Cables, Ltd., J. B. Griffiths, and A. Brown. June 1st, 1937. (Cognate application 30450/37.) (498034.)

15233. "Frequency-changing systems." C. P. Stocker. June 18th, 1936. (498035.)

17542. "High-frequency signalling systems." Ferranti, Ltd., and M. K. Taylor. June 24th, 1937. (498037.)

17971. "Electrical resistances" S. Bracco. June 26th, 1936. (498135.)

18360. "Measurement of the electrical conductivity of liquids." Siemens & Halske Akt.-Ges. July 1st, 1936. (Cognate applications 18361/37 and 18362/37.) (498298.)

18363. "Devices for the impulse testing of electrical machines and apparatus under operating voltages." Siemens-Schuckertwerke Akt.-Ges. July 1st, 1936. (Cognate application 18364/37.) (498231.)

18506. "Electric connections." A. E. F. Thomas. July 3rd, 1937. (498233.)

18537. "Electro-magnetic operating devices for imparting to-and-fro motion." H. List. July 3rd, 1937. (498041.)

18553. "Variable electrical condensers." British Mechanical Productions, Ltd., and K. N. Hawke. July 3rd, 1937. (498389.)

18572. "Method of and apparatus for the transmission of speech and other sounds." J. Poliakoff and O. B. Sneath. July 5th, 1937. (498468.)

18599. "Methods of modulating carrier waves." Fernseh Akt.-Ges. July 10th, 1936. (498304.)

18663. "Electric valve-converting apparatus. British Thomson-Houston Co., Ltd. July 3rd, 1936. (498474.)

18684. "Telephone or like systems." Automatic Telephone & Electric Co., Ltd., and W. Saville. July 5th, 1937. (498310.)

18729. "Transmission of electric signals at radio frequencies." A. C. Cossor (Holdings), Ltd., L. H. Bedford, and R. Pollock. July 6th, 1937. (498475.)

18800. "Reflectors for electric or other lamps." A. G. Horton. July 6th, 1937. (498397.)

18814. "Automatic switches as used in telephone or like systems." Automatic Telephone & Electric Co., Ltd., J. St. C. W. Graham. July 6th, 1937. (498399.)

18873. "Electrically operated suction cleaners." General Electric Co., Ltd., and H. C. E. Jacoby. July 7th, 1937. (498141.)

18889. "Apparatus for volume range expansion applied to the reproduction of electric oscillations." O. K. Kolb. (K. H. F. Schlegel.) July 7th, 1937. (498235.)

19008. "Electric conductors." Callender's Cable & Construction Co., Ltd., H. Hill, and T. B. Rose. July 8th, 1937. (498142.)

19087. "Cathode-ray tubes." A. C. Cossor, Ltd. E. E. Shelton, and B. C. Fleming-Williams. July 9th, 1937. (498484.)

19113. "Wireless direction-finding systems." Standard Telephones & Cables, Ltd., and C. F. A. Wagstaffe. July 9th, 1937. (498417.)

19399. "Latching means for electric switches." General Electric Co., Ltd., A. R. Searle, and R. Warner. July 13th, 1937. (498321.)

20009. "Automatic circuit-breakers and similar electrical switchgear." J. A. Crabtree & Co., Ltd. (Schiele Industriewerke.) July 20th, 1937. (Cognate application 30943/37.) (498325.)

20011. "Means for setting and adjusting the limit-current value of an overload release device for electrical switchgear." J. A. Crabtree & Co., Ltd. (Schiele Industriewerke.) July 20th, 1937. (Cognate application 31426/37.) (498326.)

20057. "Recording of sounds and other oscillations upon a moving light-sensitive surface." Scophony, Ltd., and G. Wikkenhauser. July 20th, 1937. (498146.)

20258. "Plug-and-socket connections." T. W. Guthrie and G. Becker, Ltd. July 21st, 1937. (498418.)

21190. "Electrical wave transmission networks." Standard Telephones & Cables, Ltd. September 12th, 1936. (498332.)

21220. "Dust cores for inductance coils." Siemens & Halske Akt.-Ges. July 31st, 1936. (498150.)

21676. "Electrical heating devices or appliances." R. J. Neil and Hy Heat Productions, Ltd. September 6th, 1937. (498333.)

22238. "Variable-reactance transformers." British Thomson-Houston Co., Ltd., G. E. Vivian and J. G. Wellings. August 12th, 1937. (498160.)

22494. "Apparatus for electrostatic separation of particles." International Titanium, Ltd. August 24th, 1936. (498246.)

22703. "Carrier current transmission systems." Allgemeine Elektricitäts-Ges. August 20th, 1936. (498062.)

23645. "Vacuum-tight seals for electric-current leads into fused quartz glass." Thermal Syndicate, Ltd., and F. Reynolds. August 30th, 1937. (498065.)

23723. "Electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 2nd, 1936. (498167.)

23997. "Electric lamps." Wilmot-Breeden, Ltd., and R. P. Turner. September 2nd, 1937. (498248.)

24268. "Snap-action electric switches." Wilmot-Breeden, Ltd., and R. P. Turner. September 6th, 1937. (498070.)

24327. "Thermionic valves and circuit arrangements employing same." British Thomson-Houston Co., Ltd. September 5th, 1936. (498339.)

24574. "Method of and means for the suppression of radio disturbances from electrical apparatus." English Electric Co., Ltd., H. B. Sedgfield, and H. S. Pound-Corner. September 9th, 1937. (Cognate application 29132/37.) (498072.)

24623. "Electric relays." Allmänna Svenska Elektriska Aktiebolaget. September 16th, 1936. (498173.)

24922. "Thermally operated electric switches." A. R. J. Ramsey (Automatic Control Corporation). September 13th, 1937. (498249.)

24944. "Ceiling-rose or like electric connector fitting." F. G. Gibbins. September 14th, 1937. (498176.)

25003. "Ultra-violet ray emitters and their envelopes." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen.) September 14th, 1937. (498177.)

25393. "Piezo-electric crystal holders." Marconi's Wireless Telegraph Co., Ltd. October 31st, 1936. (498340.)

26138. "Manufacture of electric lamps capped at each end." General Electric Co., Ltd., and C. G. Eden. September 27th, 1937. (498182.)

26375. "Electrically heated cushions and the like." E. R. Blaikie. September 29th, 1937. (498074.)

2621. "Frequency stabilisation systems." Standard Telephones & Cables, Ltd. October 17th, 1936. (498186.)

27400. "Control systems for electric motors driving reciprocating machines." British Thomson-Houston Co., Ltd. October 9th, 1936. (498195.)

28591. "Metal-vapour electric convertors." English Electric Co., Ltd., and W. R. Evans. October 20th, 1936. (498202.)

29133. "Metal-vapour electric convertors." English Electric Co., Ltd., and W. R. Evans. October 25th, 1937. (498206.)

29843. "Electric valve vircuits." British Thomson-Houston Co., Ltd. October 31st, 1936. (498210.)

30429. "Method and arrangement for transmitting a frequency band over lines." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 9th, 1936. (498088.)

31749. "Incandescent electric lamps." A. Van Dyck. November 18th, 1936. (Cognate application 31750/37.) (498092.)

31813. "Continuous interrupters for electric circuits." J. R. F. Terrell. November 19th, 1936. (498093.)

32265. "Electric-discharge tubes for amplifying or generating electric oscillations." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 25th, 1936. (498347.)

33313. "Wall plates for use in connection with electrical tumbler switches." J. A. Crabtree & Co., Ltd., H. F. McLoughlin and B. G. Harrison. December 2nd, 1937. (498098.)

34493. "Sealing of electric conductors through glass." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen). December 13th, 1937. (498102.)

34891. "Screens for cathode-ray tubes." British Thomson-Houston Co., Ltd. December 16th, 1936. (498103.)

35702. "Electro-magnetic sound recording and reproducing apparatus." C. Lorenz Akt.-Ges. December 24th, 1936. (498272.)

36097. "Circuit arrangements for operating electric-discharge devices." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen). December 30th, 1937. (498107.)

1938

861/2409/14354. "Teleprinter exchange systems." Standard Telephones & Cables, Ltd., and G. A. M. Hyde. July 9th, 1937. (Divided out of 498416.) (498425/498428/498492.)

2631. "Electric generators for simultaneously producing direct currents of different voltages." Scintilla, Ltd. January 27th, 1937. (498366.)

3579. "Call-recording arrangements in telephone or like systems." Standard Telephones & Cables, Ltd. March 10th, 1937. (498374.)

4227. "Electric circuit-breakers or the like." C. Weydemeyer, A. Kress and M. Zander. February 10th, 1937. (498433.)

4544. "Electrostatic microphone systems." E. Reisz. February 14th, 1938. (498436.)

5117. "Electric signalling systems for navigational purposes." West Instrument Co. April 17th, 1937. (498279.)

5170. "Electric transmission circuits." Standard Telephones & Cables, Ltd. April 26th, 1937. (498439.)

5893. "Electric signalling systems." Siemens & Halske Akt.-Ges. March 6th, 1937. (498444.)

6866. "Tubes or guides for the transmission of electro-magnetic waves." Allgemeine Elektricitäts-Ges. March 4th. 1937. (498116.)

8642. "Insulating-structures for current collectors." Firestone Tyre & Rubber Co., Ltd. March 19th, 1937. (498447.)

17536. "Alarm mechanism for electric clocks." H. E. Moore and W. J. Rickets. July 20th, 1937. (Divided out of 497294.) (498122.)

18532. "Overload-released contact mechanism for automatic electric switches." J. A. Crabtree & Co., Ltd. (Schiele Industriewerke). July 20th, 1937. (Divided out of 498325.) Cognate application 31212/37.) (498376.)

21019. "Electric furnace for the melting of glass." V. F. Feeny. (Soc. Anon. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny et Cirey.) August 11th, 1937. (Divided out of 489207.) (Convention date not granted.) (498379.)

21503. "Cathode-ray tubes." A. C. Cossor (Holdings), Ltd., E. E. Shelton and B. C. Fleming-Williams. July 9th, 1937. (Divided out of 498484.) (498491.)

32170. "Metal boxes or cases for housing electrical apparatus and the cable or conduit connections for use therewith." J. A. Crabtree & Co., Ltd., H. F. McLoughlin and B. G. Harrison. July 1st, 1937. (Divided out of 497857.) (498411.)

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Australia.—MELBOURNE.—March 20th. Posts and Telegraphs Department. Underground cable. (T. 17692/39.)*

March 21st. Postmaster-General's Department. Seven engine generator sets and associated equipment. (T. 17061/39.)*

BRISBANE.—March 17th. City Council. Nine 11,000-V metal-clad switch equipments, control board equipment, eight 660-V metal-clad switch equipments and power and control cables. (T. 17216/39.)*

Bexhill. — February 6th. Electricity Department. 200/750-kVA transformers for 11-kV system and a low-voltage, air-break switchboard. (January 27th.)

Birkenhead.—February 14th. Electricity Department. Electric lamps, extra-high- and low-voltage switchgear and transformers for twelve months, and one 5,000-kVA transformer. (See this issue.)

Blackburn.—February 27th. Electricity Undertaking. Cable, wire and meters for twelve months. (See this issue.)

Blackpool.—February 9th. Electricity Department. Electricity meters for twelve months. (January 27th.)

Bromley.—February 10th. Electricity Department. Extra-high- and low-voltage cable. (January 27th.)

Cardiff.—February 6th. Electricity Department. Meters, cables, conductors and lamps for twelve months. (January 20th.)

February 13th. E.h.v. sub-station switchgear, house-service meters and extra-high- and low-voltage, p.i. cables for twelve months. (January 20th.)

Cheadle and Gatley.—February 13th. Electricity Department. Stores and materials for twelve months. (January 27th.)

Chesterfield.—February 15th. Electricity Department. 2,600 y. of extra-high- and low-voltage, p.i., lead-covered, steel armoured cables and two outdoor-type transformer kiosks. (See this issue.)

Colchester.—February 13th. Essex and Colchester Mental Hospital Committee. 200-kW high-speed generating set for Severalls Mental Hospital, County architect. County Hall, Chelmsford (deposit £2 2s.).

Dundee.—February 15th. Electricity Department. Low-voltage, p.i., lead-covered cable. (January 27th.)

Egypt.—CAIRO.—March 12th. Ministry of Public Health. Three indoor and three outdoor 50-kVA transformers. (T. 17662/39.)*

Edinburgh.—February 10th. Corporation. Alteration to electric lighting installation in two wards at Bangour Mental Hospital. Town Clerk.

Epsom and Ewell.—February 20th. Electricity Department. One 300-kVA transformer and extra-high-voltage switchgear. (January 27th.)

Erith.—February 13th. Electricity Department. Stores and materials for twelve months. (January 20th.)

Falkland.—February 6th. Town Council. Electrical work at twenty-four houses. Town Clerk, Bank Buildings.

Finchley.—February 27th. Electricity Department. Stores and materials for twelve months. (See this issue.)

Gainsborough.—February 17th. Electricity Department. Two 3-phase oil-cooled transformers, low-voltage, p.i. cables, meter boards and joint box compound. (January 20th.)

Gellygaer. — February 17th. U.D.C. Stores and materials for twelve months. (January 20th.)

Gloucestershire. — Low-pressure hot water and heating installation and electric lighting at proposed Kingswood Senior Boys' School. County architect, Shire Hall, Gloucester (deposit £2 2s.).

Great Yarmouth.—February 14th. Electricity Supply Department. Cables, meters, transformers, lamps, cookers, water-heaters, kiosks and switchgear for twelve months. (January 20th.)

Halifax.—February 17th. Electricity Department. Turbine house steelwork and electric travelling crane. (January 27th.)

Heston and Isleworth.—February 15th. Electricity Department. Stores and materials for twelve months. (January 27th.)

Horsforth.—February 4th. U.D.C. Low-voltage electric power cables at the new borehole and high level pumping stations in Scotland Lane. Clerk of the Council, Council Offices.

Huddersfield.—February 11th. Education Committee. Electric lighting fittings at extensions to the technical college, Queen Street South. Town Clerk, Town Hall (deposit £2 2s.).

India.—CALCUTTA.—February 14th. Indian Stores Department. Switchboard panels, power house crane and motor-driven air compressor for the railway power house at Mari Indus. (T.Y. 17647/39.)*

NEW DELHI.—February 7th. Indian Stores Department. Porcelain insulators for twelve months. (T. 17650/39.)*

Kettering.—February 27th. Electricity Undertaking. Extra-high- and low-voltage cables, AC meters for twelve months, and two transformers. (See this issue.)

Leeds.—February 15th. Electricity Department. Stores and materials for twelve months. (January 27th.)

February 10th. Transport Department. General stores, including electric lamps for twelve months. Town Clerk, Civic Hall (deposit £1 1s.).

Letterkenny (EIRE). — February 11th. Committee of Management of Donegal Mental Hospital. Installation of electric lighting, conduit fittings, switchgear, low-pressure hot-water installation, kitchen and laundry equipment and incidental works. Plans and specifications from P. J. Courtney, R.M.S. Mental Hospital.

Leyton. — February 13th. Electricity Department. Two 500-kVA transformers. (January 27th.)

London.—H.M. OFFICE OF WORKS.—February 14th. Low-voltage, ironclad switchgear distribution boards for Pembrey R.O.F. (January 27th.)

February 17th. Lightning protection system for Pembrey R.O.F. (January 27th.)

February 21st. Low-voltage cable and accessories at Blackburn R.O.F. (January 27th.)

HACKNEY.—February 22nd. Electricity Department. Electrical stores and materials for twelve months. (See this issue.)

ISLINGTON.—February 17th. Borough Council. Electric cookers, water-heaters and wash-boilers for twelve months. (See this issue.)

Long Eaton.—February 18th. Electricity Department. Cut-outs, meters, cables and joint boxes for twelve months. (See this issue.)

Middlesex.—February 22nd. County Council. Electrical sundries for twelve months and X-ray and lighting requisites for six months. (January 27th.)

The County Council invites applications from contractors for the addition of their names, as from June 1st, to the County Council's approved list of contractors for building and engineering works by March 4th. (See this issue.)

Middleton.—February 11th. Electricity Department. Extra-high- and low-voltage cables. (January 27th.)

New Zealand. — WELLINGTON.—February 28th. Public Works Department. One 11-kV oil-circuit-breaker for the R.N.Z.A.F. station, Ohakea. (T. 17306/39.)*

March 21st. One complete set of 50-kV, 33-kV and 11-kV outdoor switchgear and steelwork. (T. 17212/39.)*

May 2nd. Six 8,000-kVA, 11,000/63,500-V transformer units. (T. 17197/39.)* Two vertical shaft 25,000-kVA AC generators and turbines. (T. 17198/39.)*

May 9th. Turbine, generator and control equipment. (T. 17210/39.)*

February 14th. Internal combustion engines and generating sets. (T.Y. 17299/39.)*

February 25th. Distribution switchboard for the R.N.Z.A.F. station, Ohakea. (T.Y. 17305/39.)*

May 9th. Four 9,333-kVA transformers, complete with accessories. (T. 17208/39.)*

Perth and Kinross.—February 8th. Education Committee. Electrical and heating installations at additions to Kinross Public School. Schedules, A. Watt Allison, architect, County Offices, Perth (deposit £2).

Plymouth.—February 4th. Electricity Department. Cables, meters, time switches, joint boxes and stevedore's work. (January 20th.)

Salford. — February 15th. Electricity Department. Electrical stores and materials. (January 27th.)

Sheffield.—February 10th. Electricity Department. Standard distribution transformers for twelve months. (January 20th.)

March 13th. Thirty-eight 11,500-V, 5,000-kVA and three 33,000-V, 15,000-kVA reactors. (See this issue.)

South Africa.—JOHANNESBURG. — City Council. February 18th. 60 miles of copper conductor. (T. 17160/39.)*

February 18th. 300 large, 1,200 medium and 1,600 straight-through joint boxes. (T. 17882/39.)*

February 22nd. Twelve 200-kVA, eighteen 250-kVA, eighteen 300-kVA, and eighteen 400-kVA transformers. T. 17810/39.)* Quantities of pin and shackle low-voltage insulators. (T. 17811/39.)* Low-voltage lightning arrestors. (T. 17809/39.)*

CAPE TOWN.—February 15th. Electricity Department. Quantities of ironclad service cut-outs. (T. 17335/39.)*

PRETORIA.—February 9th. Union Tender and Supplies Board. 4,250-ft. of 0.0225 sq. in. underground cable. (T. 17484/39.)*

St. Helens.—February 10th. Electricity Department. Fire-extinguishing equipment. (January 27th.)

Stoke-on-Trent.—February 8th. Electrical Engineer's Department. AC Meters for twelve months. (January 20th.)

Torquay.—February 10th. Electricity Undertaking. High- and low-voltage, p.i., v.i.r. cables. (See this issue.)

Tredegar.—February 13th. Electricity Department. Stores and materials for twelve months. (January 27th.)

Walthamstow.—February 24th. Electricity Undertaking. High- and low-voltage cables for twelve months. (See this issue.)

Walton and Weybridge.—February 14th. Electricity Department. Stores and materials for twelve months. (See this issue.)

Wolverhampton.—February 20th. Borough Council. Electrical engineering stores for twelve months. (January 20th.)

Workington.—February 18th. Electricity Supply Department. One 300-kVA and one 100-kVA transformer. (See this issue.)

Worthing.—February 8th. Electricity Department. Extra-high- and low-voltage cables. (January 27th.)

Orders Placed

Birmingham.—Electricity Committee. Accepted. Electric lighting installation in schools: Senior Department, Cockshut Hill (£900), Benson Road (£105), Dennis Road (£135) and Slade Road (£126).—H. Pratt. Alma Street (£169).—Baxter & Impey. Westminster Road

(£136).—Gordon Hughes Electrical Co. City Road (£259).—Parker, Winder & Achurch. Aston Hall Road (£244).—W. A. Gazard & Son.

Finchley.—Electricity Committee. Recommended. Transformers for twelve months.—Bruce Peebles & Co.

Grimsby. — Electricity Committee. Recommended. Boiler alterations at power station (£2,467).—Clarke, Chapman & Co.

Assistance Committee. Recommended. Mobile X-ray unit for Institution (£453).—H. E. Dean & Co.

Middlesex.—Education Committee. Accepted. Electrical work at Bath Street school, Harlington (£838).—Colston Electric Co.

Health Committee. Accepted. Electrical installation at Netley Castle Homes, Southampton (£657).—Read & Partners. Electrical installation at Mundesley Homes (£655).—Lowestoft Electric Co.

Morecambe. — Electricity Committee. Accepted Six 400-kVA transformers.—Electric Construction Co.

Newcastle-on-Tyne. — City Council. Accepted. Electrical installation at the hospital maternity block (£628).—Falconar, Cross & Co.

Stoke-on-Trent.—Housing Committee. Accepted. Electrical installations at council houses: 170 at Trent Vale (£1,487), twenty-four at Abbey Hulton (£204) and twenty at Bucknall (£157).—F. Hancock. Forty houses at Fenton (£284) and 178 at Meir (£1,255).—E. Holloway & Co.

Wimbledon. — Electricity Committee. Recommended. Transformers: One 1,000-kVA (£395).—Bonar Long & Co. Thirteen 200-kVA (£107 each).—Foster Engineering Co. Thirteen 200-kVA (£107 each).—Bryce, Ltd.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Acton. — Extensions to factory, for Beethoven Electrical Equipment, Ltd., Chase Road; I. Schultz, architect, 101, Alexandria Road, N.W.8. Extensions to factory, for Muller & Co. (England), Ltd., 85, Chase Road; T. Jauratt, architect, 90, Charterhouse Avenue, Wembley.

Alston.—Houses (18), for the R.D.C.; North-Eastern Housing Association, Northumberland Road, Newcastle-on-Tyne.

Altrincham. — Municipal Lodging House (£5,625), for T.C.; H. E. Brown, borough surveyor.

Banstead.—Rebuilding administrative block, nurses' hostel, &c., Princess Elizabeth Hospital for Women and Children; H. S. Goodheart-Rendel, architect, 13, Crawford Street, London, W.1.

Barking. — Extensions to factory, Alfred's Way; Lomas, Ltd. Extensions to Eastbury Erkenwald schools (£17,200); McClelland & Co., Ltd.

Birmingham. — Factory, for Messrs. Stevenson, Alcester Street; W. C. Skinner. Ltd., contractors, 316, Birchfield Road. Shops and houses, Witton Lodge Lane, Erdington (£10,500); W. S. Brockington, Thornhill Road, Streetly.

Boldon Colliery (Co. DURHAM).—Additions to intermediate school for the C.C.; Summerbell and Son, builders, Tyne Dock, South Shields.

Brierley Hill. — Houses (148), Three estates; U.D.C. surveyor.

Brighouse. — Houses (96), Lillilands estate; borough engineer.

Bucknall (STAFFORDSHIRE). — Houses (50), near High Street; Cotton, Son & Hulme, architects.

Bungay.—Houses (70), Bungay-Beccles Road site; F. J. Ingram, U.D.C. architect, 18a, Earsham Street.

Chertsey. — Houses (53), Woodham Lane; G. W. Wilks Bros., Woodham Lane, New Haw.

Chesterton. — Houses (120), Cross Heath; W. Johnson, builders, 277, Dimsdale New Road, Wolstanton, Staffordshire.

Coventry.—Houses; Bayliss Bros., Edgewick Park estate, Court House Green, Coventry. Houses (24); Bratby & Sons, builders, St. Ives Road.

Croydon.—Factory, Hospital Road, for W. Howard Price, Ltd., Lower Coombe Street.

Denbigh.—Extensions to hospitals, for the North Wales Counties Mental Hospital Committee (£220,000).

Derbyshire. — School, near Old Derby Road and Derby Road, Ashbourne; J. Harrison, county architect, County Offices, St. Mary's Gate, Derby.

Doncaster.—Nurses' home (£20,000), for Royal Infirmary Management; H. Ford, chairman.

Droylsden.—Houses (210), Sunny Side Road, Greenside estate; W. Chappell & Sons, Ltd., Droylsden.

Dundee.—Blocks of 280 houses (first development), Magdalen's Kirkton; D. B. M'Lay, architect, 91, Commercial Street, Dundee.

Dunfermline.—Ice rink, Halbeath Road (£36,000), for Dunfermline Ice Rink, Ltd.; Colin C. Fraser, architect.

Durham.—School, Pekton-Newfield, for the C.C. (£38,000); Hadden and Hillman, Ltd.; builders, 127, New Bridge Street, Newcastle-on-Tyne. School, Wheatley Hill, for the County E.C. (£28,000); Scott Developments, Ltd., builders, Rosemary Avenue, West Molesey. Improvements to Durham Institution and offices, Easington, for the County P.A.C.; W. J. Merrett, county architect, 20, Old Elvet, Durham.

Gloucestershire.—Poor Law Institution, Stroud, for C.C. (£200,000).

Gravesend. — Police and fire station (£84,000), for T.C.; J. B. Bennett, architect, 4, Woodville Terrace.

Grimsby.—Welfare centre, Hope Street (£4,500); Swaby & Walsham.

Guildford. — Public hall, courthouse and police station (£109,355), The Firs site, London Road; borough surveyor.

Hendon.—School, Broadfields Avenue, Edgware, for E.C.; director of education, Town Hall, Hendon, N.W.4.

Hertford.—Reconstruction of Castle Cinema, for Shipman & King, Ltd.; Howis & Belcham, architects, Fenchurch Street, London, E.C.3.

Huddersfield.—Houses (898), Dalton estate; W. Jagger, borough engineer.

Ilford.—Houses (106), Torquay Gargens; P. G. Ashton & Sons.

Jarrow-on-Tyne. — Houses (50), for single aged persons, Central Ward, community centres, housing estates, and swimming baths and gymnasium (£32,000); borough engineer.

Kirkcaldy. — Municipal buildings, Wemyssfield, Hunter Street and Whytescauseway (£100,000); David Carr, architect, Edinburgh.

Lancashire.—R.C. schools, Walton-le-Dale (£26,000), Milnrow (£26,480), and Turton (£39,832); also enlargement of technical school, Horwich (£17,481), and Higher Lane school, Whitefield (£22,337), for the County E.C.

Leeds.—Children's hospital. Moortown estate, for T.C.; Stanley Hall and Easton and Robertson, architects, 54, Bedford Square, London, W.C.1.

London.—(HAMMERSMITH.).—Offices and showrooms, 19-20, Hammersmith Bridge Road; Stodart & Jefferies, 21, Bedford Row, W.C.1. (LEWISHAM).—Cinema, at the corner of Southend Lane, Bellingham; T. Spencer Bright & Co., 1, New Court, W.C.2.

Long Eaton.—Houses (66), Meadow Lane; Co-operative Society, Ltd., Station Street.

Manchester. — Libraries, Ardwick (£16,826) and Collyhurst (£19,880); city architect.

Meriden.—Houses (32) in blocks of 2 and 4, Marsh Lane, Water Orton; J. Larkman & Sons, William Cook Road, Birmingham, 8.

Middlesbrough.—First section of art gallery scheme (£7,000) and libraries, Grove Hill and Whinney Banks, for the T.C.; C. Gorman, borough engineer. Ice skating rink, Linthorpe; J. W. Verity, agent for promotors, 64, Green Lane, Middlesbrough.

Middlesex.—Technical school, Fryent Way, Kingsbury Circus (£28,000), for E.C.; county architect.

Morecambe.—Private hotel, Marine Road; Taylor & Bleasdale. Widening of promenade (£93,830); Harbour & General Works, Ltd.

Newbury.—Houses (30), Pyle Hill, Greenham; D. Houghton.

Newcastle-on-Tyne.—Houses (1,500), for the City Council, in connection with clearance plans; city architect, 18, Cloth Market. Factory, Robson Street, for E. Malia; R. Burke, architect, Singleton House, Northumberland Road. Mineral water factory, Benfield Road, for Tizer, Ltd.; H. B. Bearon, architect, 11, The Rock, Bury, Lancashire. School, Gosforth, with electrical work; Thompson & Son, builders, Grey Street, Newcastle-on-Tyne. Shops, the Fossway, for Newcastle Co-operative Society; C.W.S. architects' dept., 90, Westmorland Road. Extensions to pathological dept., and students' lecture hall, at Royal Victoria Infirmary (£18,000); Newcombe and Newcombe, architects, Eldon Square.

Newcastle-under-Lyme. — Houses (20), near Temler Terrace, Porthill; Hartshill Development Co., Ltd., contractors, 559, Hartshill Road, Stoke-on-Trent.

Northampton.—Houses (25), Spencer estate; borough engineer.

Oxford.—A.R.P. shelters, Gloucester Green (£50,000); borough surveyor.

Penybont.—Houses (98), Sarn & Pyle estates; R.D.C. surveyor.

Rowley Regis.—Houses (114), for the T.C.; Clifford Buckley, town clerk, municipal Buildings, Old Hill.

Sheffield.—Factory and offices, Claywheel Lane; Hadfield & Cawkwell, architects, St. James Street.

Stockport.—Libraries, Edgeley, Heaton Moor, Cheadle Heath, and Portwood (£19,200); borough surveyor. School, Broadstone Hall Road, North Reddish, for the E.C.; L. Yates, education architect, Education Offices, Town Hall.

Stoke-on-Trent.—Baths (£59,750); city engineer.

Stowmarket. — Council offices, Red Gables; U.D.C. surveyor.

Sunderland.—Houses (1,800), under five years' plan, for the T.C., and laundry (£16,000) and relief office on the Ford estate (£1,000), for the P.A.C.; J. E. Lewis, borough engineer.

Sutton Coldfield.—Houses (15), Ashurst Road; A. C. Knight & Co. Extensions to Riland Road depot (£6,150); W. James & Son.

Tottenham.—Houses (36), Scotland Green; W. F. Marshall, Ltd., 71, Stradbroke Grove, Buckland Hill, Buckhurst. Cold storage depot, Marsh Lane; J. Lyons & Co., Ltd. R.C. school (£25,000), for the E.C.

Upholland.—Cinema, for Dickinson Bros., Dingle.

Urmston.—Houses (58), Croft Hall estate, Davyhulme; F. Entwistle, builder, Barton Road, Davyhulme, Manchester.

Wallasey.—Clinic and health offices, Woodstock Road; W. M. Law & Sons, Liverpool.

Walsall.—Shops, Walstead Road and Delves Green Road; W. E. Holmes.

Washington.—Houses (100), Well Bank Road; L. T. Broome, U.D.C. surveyor.

Wellingborough.—Extensions to factory, for Almarco Metal Windows, Ltd., London Road.

Welwyn Garden City.—Factory and warehouse, for Barclay's Corsets, Ltd.; L. de Soissons, architect, Blue Bell Yard, St. James's Street, London, S.W.1.

West Bromwich.—Houses (178), Hemstead Village; Hemstead Colliery Co.

West Drayton.—Factory, Trout Lane, for English Metal Powder Co., Ltd.

Willenhall.—Houses (176), Portobello estate; U.D.C. surveyor.

Wisbech.—Isolation hospital, for Joint Hospital Board; Ward & Wootnough, architects, 8, South Brink, Wisbech.

Wishaw. — Cinema, Kirk Road, for George Green, Ltd., 182, Trongate, Glasgow, C.1.

Yorkshire.—School, Garforth, Leeds, for the West Riding E.C.; J. Mansell Jenkinson, architect, 18, Norfolk Row, Sheffield. School, Goole-Knottingley Road, Snaith, for the West Riding E.C.; H. Wormald, education architect, Education Offices, Wakefield.